STOPPING WATER POLLUTION AT ITS SOURCE

MISA

Municipal Industrial Strategy for Abatement

KAMINISTIQUIA RIVER

WATER QUALITY STUDY

PART 5:

EFFLUENT AND RECEIVING WATER TRACE CONTAMINANT ANALYSIS

Ontario

Environment
Environnement

ISBN 0-7729-7072-6

KAMINISTIQUIA RIVER WATER QUALITY STUDY

PART 5:

EFFLUENT AND RECEIVING WATER TRACE CONTAMINANT ANALYSIS

Report prepared for:
Water Resources
Environmental Services
Ontario Ministry of the Environment

Report prepared by:
S. Klose
River Systems Engineer
Water Resources Branch

JUNE 1992

Copyright: Queen's Printer for Ontario, 1992
This publication may be reproduced for non-commercial purposes
with appropriate attribution

PIBS 1253
LOG 90-2309-037

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	v
FOREWORD	vi
SUMMARY	viii
1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	3
2.1 Study Area	3
2.2 Point Source Dischargers	3
3.0 STUDY OUTLINE	7
3.1 Parameters	9
3.2 Effluent Sampling	10
3.3 Receiving Water Sampling	12
4.0 EFFLUENT CHARACTERIZATION	15
4.1 The Canadian Pacific Forest Products Company	17
4.2 Reichhold Chemical Ltd.	33
4.3 Ogilvie Mills	43
4.4 Thunder Bay Sewage Treatment Plant	48
5.0 RECEIVING WATER QUALITY	54
5.1 Screening Results	58
5.2 Spatial and Temporal Trends	66
5.3 Discussion	71
6.0 EFFLUENT LIMITS	73
6.1 The Canadian Pacific Forest Products Company	75
6.2 Reichhold Chemical Ltd., Ogilvie Mills and Thunder Bay Sewage Treatment Plant	81
7.0 CONCLUSIONS	82
REFERENCES	85
APPENDICES	
A: Parameter Listing	87
B: Effluent Sampling Results	92
C: Receiving Water Sampling Results	118

LIST OF TABLES

TABLE		Page
3.1	Remark Code Explanation	11
3.2	Receiving Water Sample Collection Summary	13
4.1	Effluent Flow Rates - 1986	16
4.2	CPFP 1986 Effluent Sampling Results - Non-detected Parameters	18
4.3	CPFP 1986 Effluent Sampling Results - Infrequently Detected Parameters	20
4.4	CPFP 1986 Effluent Sampling Results - Frequently Detected Parameters	22
4.5	CPFP - Grab Versus Composite Samples	34
4.6	CPFP Effluent Contaminant Percentiles	35
4.7	Reichhold Chemical 1986 Effluent Sampling Results - Non-detected Parameters	37
4.8	Reichhold Chemical 1986 Effluent Sampling Results - Infrequently Detected Parameters	41
4.9	Reichhold Chemical 1986 Effluent Sampling Results - Frequently Detected Parameters	42
4.10	Ogilvie Mills 1986 Effluent Sampling Results - Non-Detected Parameters	44
4.11	Ogilvie Mills 1986 Effluent Sampling Results - Detected Parameters	47
4.12	Thunder Bay STP 1986 Effluent Sampling Results - Non-Detected Parameters	49
4.13	Thunder Bay STP 1986 Effluent Sampling Results - Detected Parameters	52
5.1	Kaministiquia River Streamflow at Kakabeka Falls - Power House	57
5.2	Kaministiquia River 1986 Sampling Results - Non-Detected Parameters	59

LIST OF TABLES (Continued)

TABLE		Page
5.3	Kaministiquia River 1986 Sampling Results - Infrequently Detected Parameters	62
5.4	Kaministiquia River 1986 Sampling Results - Frequently Detected Parameters	64
6.1	CPFP Effluent Limits	80

LIST OF FIGURES

Figure		Page
2.1	Kaministiquia River Watershed	4
2.2	Lower Kaministiquia River Study Area	5
3.1	River Sampling Locations	8
4.1	CPFP Effluent Characterization	24
5.1	Average Streamflow Recurrence Interval - Kaministiquia River at Kaministiquia	55
5.2	Receiving Water Quality	67
6.1	Schematic Diagram of Lakewater Intrusion	76
6.2	CPFP Mass Balance Predictions	77

ACKNOWLEDGEMENTS

The nature and complexity of the lower Kaministiguia River necessitated a rather complex and ambitious field program. The success of the field program can be attributed to the high level of cooperation between the Northwest Region and the Watershed Management Section, both of MOE. Mr. Bacchus of the Watershed Management Section deserves many thanks for the planning and coordination of the field program.

Messrs. J. Vander Wal and D. Hollinger, Northwest Region, provided excellent support and coordination of equipment and the large number of regional staff required for the survey.

The author would also like to thank Messrs. Z. Novak and J. Vander Wal of the MOE for editing and constructive criticism in reviewing this report.

FOREWORD

The study of the Kaministiquia River, originally planned as a waste assimilation capacity investigation in 1985, was subsequently expanded and included as a Municipal Industrial Strategy for Abatement (MISA) pilot site. Inclusion of the MISA objectives for the site study expanded the range of investigation from traditional nutrient and oxygen consuming waste concerns to include all known and suspected contaminants from point source discharges to the river.

Part 1 of the Kaministiquia River water quality study presented the findings of water quality surveys carried out in 1986 as they relate to the assimilative capacity of the lower river. The findings focussed on the impact of oxygen consuming wastes.

Part 2 of this series presented the findings on the thermal structure and hydrodynamics of the river based on a joint study between the Ontario Ministry of the Environment and Environment Canada.

Part 3 of this series presented the findings on oxygen depletion in the river based on further work of the joint study between the Ontario Ministry of the Environment and Environment Canada. The waste assimilation capacity of the lower river was evaluated utilizing two-dimensional estuary modelling techniques.

Part 4 of this series presented the findings on 2,4,6 Tri-chlorophenol, Chloroform and Aluminum based on further work of the joint study between Ontario Ministry of the Environment and Environment Canada. A general water quality model based on previously developed oxygen model was developed.

This report, which is Part 5 in this series, completes the analysis of water quality survey results, from the 1986 survey, initiated in the Part 1 report. The findings focus on the impact of trace metal and organic contaminants.

In addition to the MISA study activities, the entire Thunder Bay nearshore area is under investigation as part of the Remedial Action Plan (RAP) process.

SUMMARY

The Ministry of the Environment planned and carried out water quality surveys of the lower Kaministiquia River in 1986. The objectives of the study were to re-evaluate the waste assimilative capacity of the river in terms of oxygen consuming wastes and to satisfy the broader goals of the Municipal-Industrial Strategy for Abatement (MISA) pilot site program. This report presents the results and analysis of water quality samples collected from point source discharges and the receiving water.

Grab samples as well as composite samples were collected during a short-term intensive survey from four point source dischargers to the lower Kaministiquia River. They were, the Canadian Pacific Forest Products (CPFP) Company (formerly the Great Lakes Forest Products Company), Reichhold Chemical (RC), Ogilvie Mills (OM), and the Thunder Bay Sewage Treatment Plant (STP). Grab samples only were collected from 12 stations within the lower Kaministiquia River also during an intensive short-term survey. River stations included points upstream and downstream of the four point source dischargers. The major emphasis of the sampling program focussed on the discharge from CPFP which operates a large pulp and paper mill which discharges to the Kaministiquia River approximately 10 km upstream of Thunder Bay Harbour.

Up to 148 organic and inorganic parameters were measured in samples collected from each sampling point. The major parameter test groups included:

- Organochlorines
- Chlorobenzenes
- Chlorinated Phenols
- Phenoxy Acids

Resin, Fatty and Aromatic Acids
Speciated Phenolics
Volatiles
Polynuclear Aromatic Hydrocarbons
Trace Metals

The selection of parameters for inclusion in the water quality sampling was based on an expectation of occurrence in pulp and paper mill effluents and to provide a broad based scan across a wide range of parameters.

Based on an analysis of the frequency of detection both in the effluent streams and in the receiving water, and on a comparison with criteria values, the parameters of concern for CPFP are, 2,4,6 Trichlorophenol, Dehydroabietic Acid, Total Resin Acids, Chloroform, Iron, Aluminum, Chromium and Zinc. Of these parameters only Dehydroabietic Acid, Total Resin Acids, Iron, Aluminum and Zinc exceeded criteria levels in the receiving water. Mass balance calculations, including mixing zone considerations, yielded the effluent load reductions which would be required to achieve criteria levels instream as follows: 2,4,6 Trichlorophenol and Chloroform 0%, Pentachlorophenol > 60%, Dehydroabietic Acid and Total Resin Acids > 90%, Iron and Aluminum 70 - 90%, Chromium and Zinc 20 - 30%.

Similar analyses of the remaining point source dischargers showed that no reductions are required for the parameters measured in the RC discharge. Iron would require a > 75% load reduction from the OM discharge and > 90% load reduction from the STP discharge. Additionally copper would require a > 50% load reduction from the STP. It should be noted that Iron and Aluminum exceeded receiving water criteria at the upstream end of the study area, thus load reduction predictions for all dischargers are based on reducing effluent concentrations to background levels.

The results of the water quality investigation as they relate to the impact of oxygen consuming wastes were presented in an earlier report (Klose, 1988). This report completes the analysis of water quality survey results, initiated in the earlier report, and focuses on the impact of trace metal and organic contaminants.

1.0 INTRODUCTION

In 1970, the Ontario Ministry of the Environment (MOE) conducted water quality investigations in the lower Kaministiquia River and Thunder Bay Harbour areas (MOE, 1972). The study was undertaken to evaluate the degree and extent of water quality impairment. The lower Kaministiquia River was the most seriously affected area in the study region, particularly in terms of nutrients, excessive loadings of oxygen-consuming wastes (BOD), suspended solids, accumulation of organic materials and metals in bottom deposits, bacterial contamination, aesthetic impairment and potentially toxic and tainting substances. Dissolved oxygen levels at the time of the study were well below 5 mg/L which is considered to be the concentration necessary for the protection of cold water fisheries and other desirable forms of aquatic life. The bacterial levels found suggested that accepted criteria for swimming and bathing were exceeded. The appearance of the river was severely degraded by suspended materials, scum, coloured substances, and floating oil wastes which imposed further restrictions on water-based recreational activities.

Pollution abatement programs carried out by the City of Thunder Bay and the major industries in the area, following the 1970 survey, have significantly improved the water quality. Concerns over impaired dissolved oxygen levels remain. Fish kills were reported in 1977 and 1980 (Beak, 1986).

The study of the Kaministiquia River, originally planned in 1985 as a waste assimilation study, was subsequently expanded and included as a Municipal Industrial Strategy for Abatement (MISA) Pilot Site. In 1986, the MOE carried out a water quality investigation of the lower Kaministiquia River to:

(1) re-evaluate the waste assimilation capacity, and:
(2) develop water-quality based techniques for setting effluent limits as part of the MISA Program.

MISA is a comprehensive program initiated to control water pollution at

its source. This discharge of toxic metals and organics is to be controlled through the use of technology-based and water quality-based effluent limits. A complete description of the program can be found in the Ministry of the Environment's publication "Municipal-Industrial Strategy for Abatement (MISA)" (MOE, 1986).

The results of the water quality investigation as they relate to the impact of oxygen consuming wastes were presented in an earlier report (Klose, 1988). This report completes the analysis of water quality survey results, initiated in the earlier report, and focuses on the impact of trace metal and organic contaminants.

2.0 SITE DESCRIPTION

2.1 Study Area

The Kaministiquia River rises in Dog Lake, situated about 40 km. northwest of Thunder Bay, and drains an area of approximately 6800 sq. km., see Figure 2.1. The Shebandowan Lakes also feed the river via the Shebandowan River. Discharges from these lakes are regulated by control dams to facilitate hydro-electric power generation. Ontario Hydro regulates flow through control and operation of the Silver Falls Dam and Generating Station, the Shebandowan Lake Dam and the Kakabeka Falls Dam and Generating Station. Ontario Hydro maintains a minimum flow of 17 m^3/s at Kakabeka Falls Dam and Generating Station during the summer months.

The study area, as shown in Figure 2.2, covers the lower 10 km. of the Kaministiquia River, as well as the Mission and McKellar Rivers which branch off of the Kaministiquia approximately 2 km. upstream of the Thunder Bay Harbour. The Kaministiquia River from the Westfort turning basin to the mouth, and the Mission River, have been dredged by the Canada Department of Public Works to a nominal depth of 7.6 m for commercial shipping. The McKellar River is not dredged. A very low gradient coupled with the dredging allow a significant backwater effect of Lake Superior such that this section of the river behaves similar to an estuary. Earlier studies (MOE, 1972; Klose, 1988) have shown that during summer months, a significant stratification occurs in the study area whereby warmer river water overlies colder lake water as far upstream as the Westfort turning basin. The strong thermal gradien generally precludes mixing.

2.2 Point Source Dischargers

As shown in Figure 2.2, there are 4 major point source dischargers to the lower Kaministiquia River. They are: The Canadian Pacific Forest Products Company* (CPFP), Reichhold Chemical (RC), Ogilvie Mills Limited (OM) and the Thunder Bay Sewage Treatment Plant (STP). The Ontario Hydro Thermal Generating Station and the Abitibi Paper Company Limited (Fort William Division) discharge directly into Thunder Bay Harbour.

---

*Formerly the Great Lakes Forest Products Company.

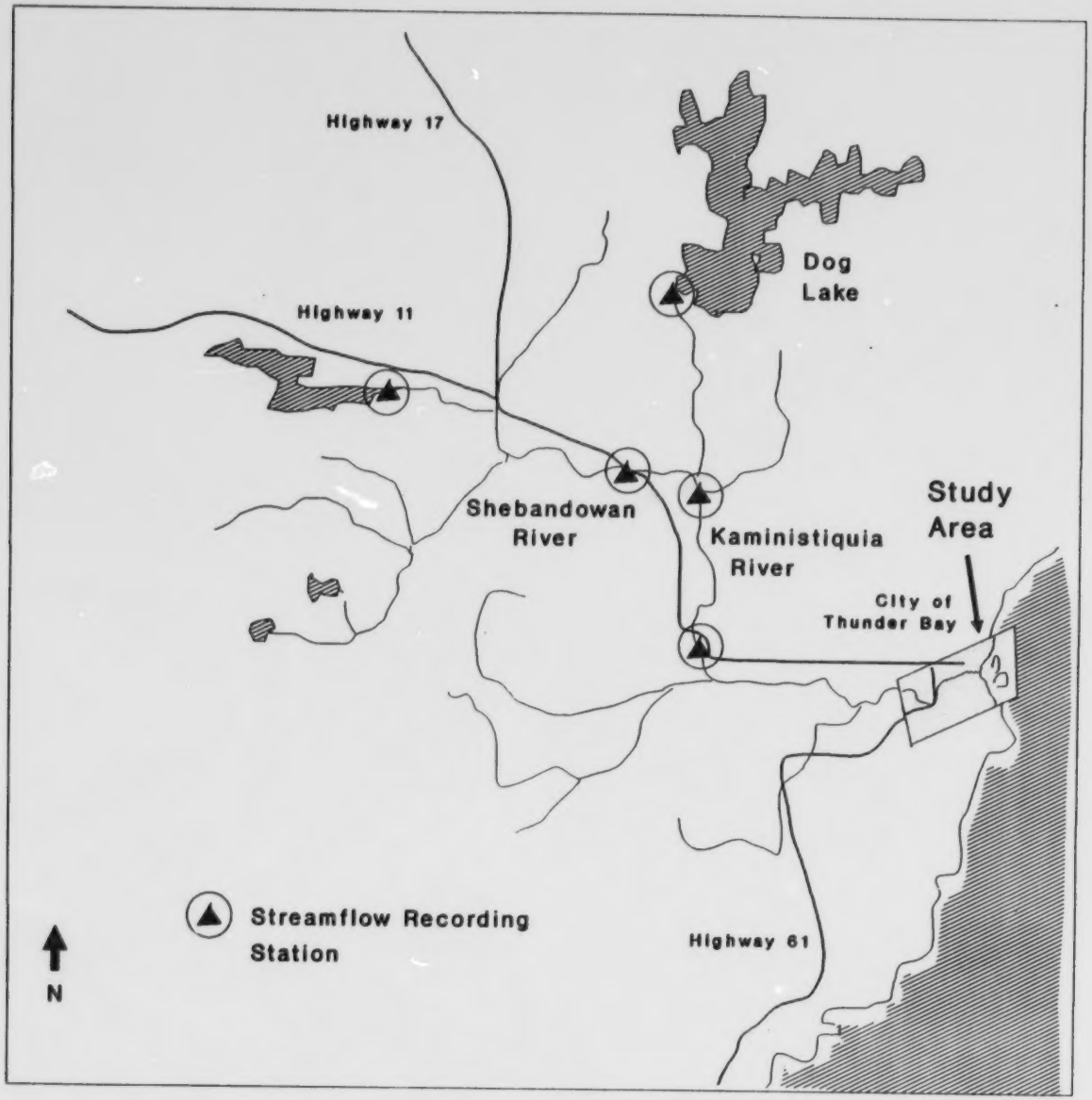


FIGURE 2.1: Kaministiquia River Watershed

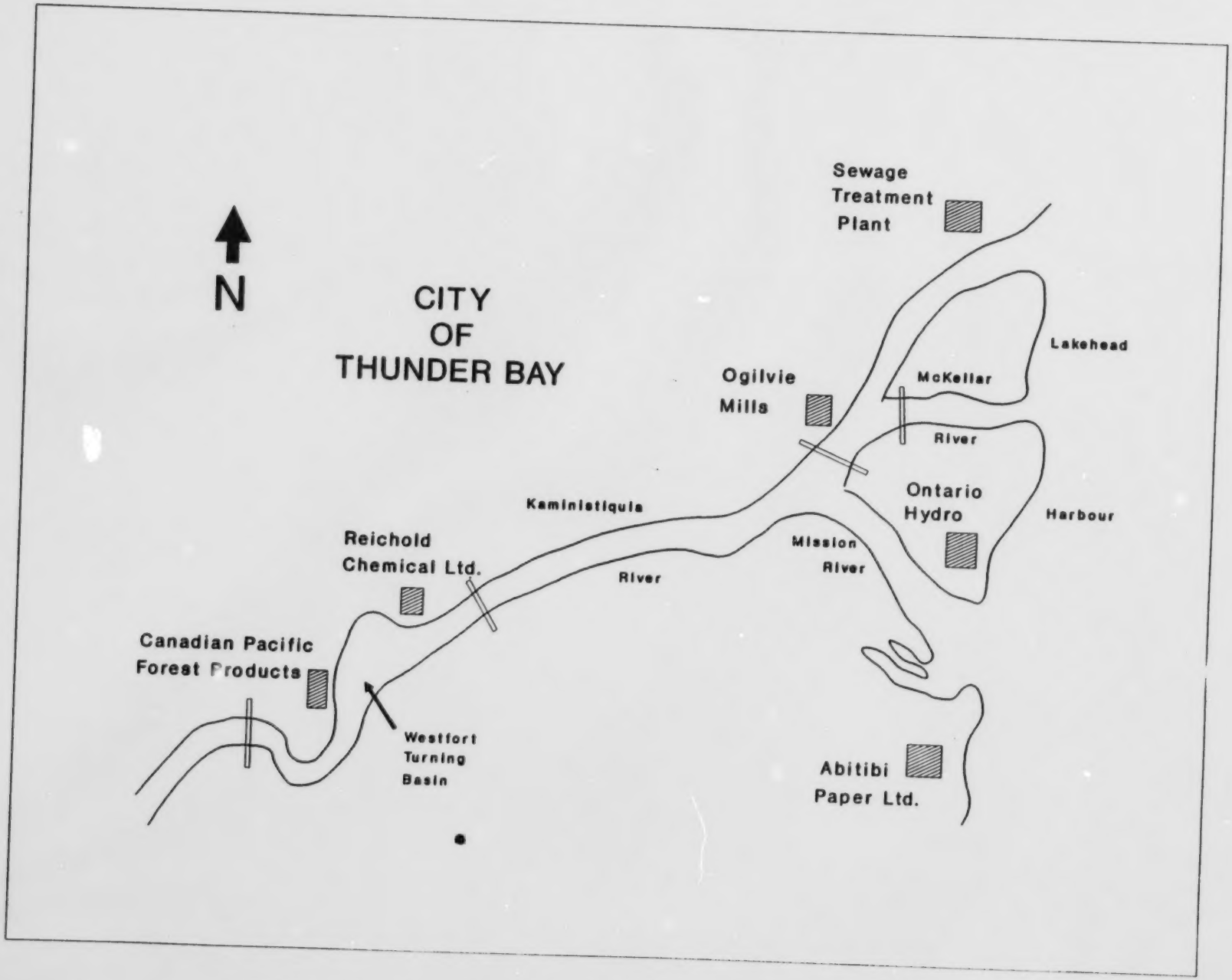


FIGURE 2.2: Lower Kiministiquia River Study Area

The Canadian Pacific Forest Products Mill originated in 1924 as a groundwood facility and a sulfite mill was added in 1926. The current facility, as a result of several expansions, is a combination groundwood, sulfite and bleached kraft pulping operation. The mill produces approximately 1100 tonnes of newsprint and 1000 tonnes of bleached kraft pulp per day using mainly a softwood mix (black spruce, jack pine, balsam fir, etc.) and some poplar in the kraft, groundwood and sulfite pulping processes. Effluent treatment includes several clarifers in the newsprint mill, pH adjustment of the kraft mill effluents, bisulfite liquor recovery, a steam stripper and a closed cycle process in the "B" kraft mill. Process water is withdrawn from the Kaministiquia River upstream of the mill and is discharged to the river via a submerged diffuser. A second outflow, "clean water discharge", discharges cooling water by way of a submerged shoreline outfall at the head of the Westfort turning basin.

The Reichold Chemical plant produces formaldehyde for use in making urea formaldehyde resin and phenol formaldehyde resin which are sold as adhesives for plywood and other wood products. Treated effluent was discharged via a bank outfall, however, the company obtained approval in January 1988 to discharge wastewater to the sanitary sewer, thus removing it as a point source discharger.

Ogilvie Mills Limited produces gluten and starch from wheat flour. Process wastewaters are discharged via a bank outfall.

The Thunder Bay sewage treatment plant is a primary treatment plant with phosphorus removal with a capacity of 24 million imperial gallons per day. Effluent chlorination is practised on a year-round basis. Treated effluent is discharged via a submerged outfall.

3.0 STUDY OUTLINE

The original planning for the study of the lower Kaministiquia River centred on conducting a waste assimilation study. As outlined in the Stream Water Quality Assessment Procedures Manual (MOE, 1980) this planning focused on the impacts of oxygen consuming waste and nutrients. The manual was utilized to lay out the sampling grid (see Figure 3.1) and to develop the sampling frequency and parameters. River sampling locations were also influenced heavily by locations used in earlier studies (MOE, 1972).

Following the introduction of the MISA program, which included six pilot site studies one of which is the Kaministiquia River, the survey plan was modified to address the MISA initiatives (MOE, 1986). These modifications generally related to the range of parameters and resulted in the addition of an extensive list of organic and inorganic parameters. Additional sampling of the effluent streams was also included.

Sample collections and submissions were carried out in accordance with Ministry procedures (MOE, 1989). Sample compositing was performed utilizing ISCO model 2700 samplers. The compositing scheme was based on withdrawing equal volumes of sample at equally spaced time intervals.

The nature and hydraulic complexity of the lower Kaministiquia River necessitated splitting the study into two general components. Firstly a physical survey was conducted from July 29 to August 1, 1986 to determine the time-of-travel between river stations as well as widths and depths. Results of this sub-component, were presented in an earlier report (Klose, 1988). The second sub-component, a water quality survey, was carried out from August 11 to August 15, 1986 and is the subject of this report.

One notable exception to the procedures outlined in the Stream Water Quality Assessment Procedures manual was that measurements of time-of-travel and the intensive water quality sampling were conducted at design flow conditions. Normally these measurements are made under dry

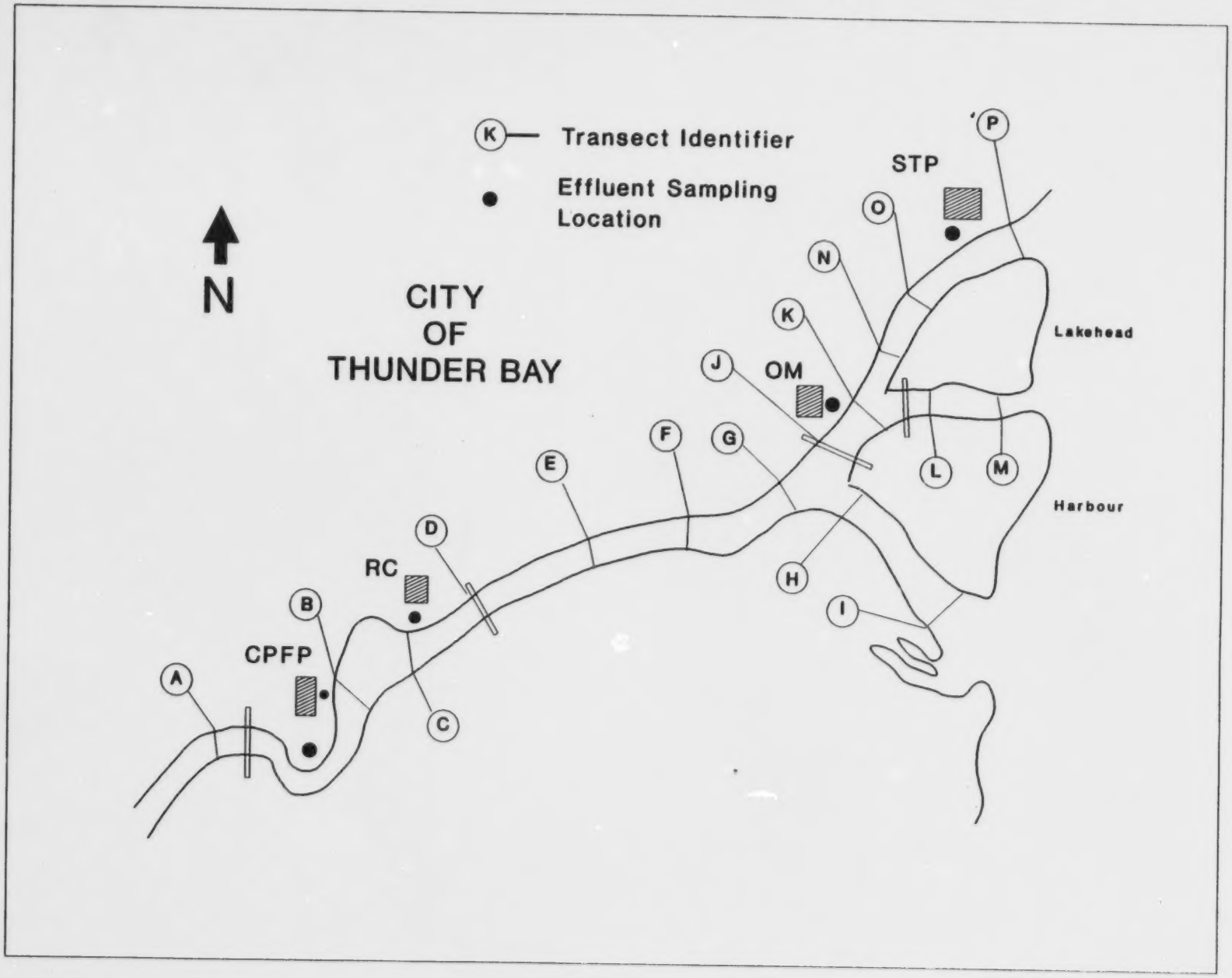


FIGURE 3.1: River Sampling Locations

weather summer conditions. The results and analyses are then extrapolated to design flow conditions. Significant backwater effects in the lower Kaministiquia River make it extremely difficult to extrapolate to design flow conditions. Arrangements were made with Ontario Hydro to regulate the Kaministiquia River such that design flow conditions would occur. A benefit to this modified procedure is that analyses and modelling can be performed on the data as collected without extrapolation.

3.1 Parameters

The selection of parameters for inclusion in the water quality sampling was based on an expectation of occurrence in pulp and paper mill effluents and to provide a broad based scan across a wide range of parameters. A procedure of the central laboratory of the Ministry is to combine individual parameter tests into larger test groups. These larger test groups will be used to present sample analysis results. The test groups utilized in the water quality sampling are as follows:

Organochlorines
Chlorobenzenes
Chlorinated Phenols
Phenoxy Acids
Resin, Fatty & Aromatic Acids
Speciated Phenolics
Volatiles
Polynuclear Aromatic Hydrocarbons
Trace Metals

A complete list of parameters included in each test group can be found in Appendix A.

As with any sampling program the shipping to and receiving of samples at a central laboratory may result in a certain level of breakage or loss of samples. Additionally methods within the laboratory may introduce uncertainties in interpreting sample results. The central laboratory of

the Ministry has developed a set of remark codes which may be included with sample results to aid in the interpretation of numerical results and to identify any problems encountered during analysis. These remark codes have been included in the presentation of the effluent sampling results (Appendix B) and the receiving water sampling results (Appendix C). A list of remark codes and accompanying explanation of those codes encountered in this study are presented in Table 3.1.

In addition to the remark codes identified above, two test groups require special attention in the interpretation of lab analysis results. Due to long storage and the possibility of losses through time and/or degradation, the results for the volatile test group must be viewed as minimum, with the exception of Dichloromethane which may be a laboratory artifact when concentrations are less than 15 ppb. For the polynuclear aromatic hydrocarbons test group the analytical method utilized was under development and yielded ranges of concentration for single samples. These results will thus only be used to indicate the possible presence or absence of a particular parameter within the group.

Samples received at the Ministry laboratory for specific parameter groups are screened and sent to either a "clean" or "dirty" analysis station. The "clean" station has lower detection levels based on the assumption that parameter concentrations are low. For this study samples were split between stations with all effluent samples going to the "dirty" station and all receiving water samples going to the "clean" station. The parameter groups included in this screening were the trace metals and volatiles. The remaining parameter groups, with the exception of PAH for which no receiving water samples were collected, had similar detection levels for effluent and receiving water samples.

3.2 Effluent Sampling

Effluent sampling consisted of a series of 24-hour composites collected from the effluent streams of the point source dischargers identified earlier. With the emphasis of the study lying on the discharge from CPFP,

TABLE 3.1: REMARK CODE EXPLANATION

Code	Explanation
<	Actual result is less than the reported value
< W	"zero" value reported is minimum measurable amount
< T	This low measurement is Tentative. For information only
CS	Contamination Suspected
UCS	Unreliable: Contamination Suspected
UCR	Unreliable: Could not confirm by Re-analysis
SPL	Several Peaks, Large, not priority pollutant
SPS	Several Peaks, Small, not priority pollutant
APL	Additional Peak, Large, not priority pollutant
APS	Additional Peak, Small, not priority pollutant
RO	Results contained numerous high level interferences
LA	Sample spoiled in Laboratory Accident
IS	Insufficient Sample
SM	Sample Missing (lost in lab??)
NR	Sample Not Received at laboratory
BT	Sample Broken in Transit
RE	Sample container Received Empty

a greater number of samples were collected at the CPFP outfalls. Due to the proximity of RC, it also was sampled at a greater frequency. Seven 24-hour composite samples were collected from the two CPFP outfalls and from RC and were analysed for all the parameter groups identified in section 3.1. Three 24-hour composite samples were collected from OM and the STP and were also analysed for all parameter groups. It should be noted that sample compositing for the volatiles test group is extremely difficult, thus two grab samples were collected within the interval of each composite and submitted for analysis as discrete samples.

Effluent quality variability also plays an import role in establishing environmental impact. While the 24-hour composite samples can provide an indication of variability on a longer time scale and can indicate the presence of infrequently occurring parameters, the within day variability can have a significant impact on receiving water quality. Effluent grab samples were collected from both outfalls of CPFP at 4 hour intervals to correspond with one of the 24-hour composite samples. Parameter groups included in the grab sampling were: Chlorinated Phenols; Resin, Fatty & Aromatic Acids; Speciated Phenolics and the Trace Metals.

Sampling to cover the waste assimilation component of the study consisted of grab samples collected every 4 to 8 hours, depending on the parameter, over a 72 hour period (see Klose, 1988).

In addition to the sampling described above, a single grab sample was collected from each discharge point during the spring of 1986 (May 9). These samples were collected to aid in identifying any seasonal changes in discharge quality.

3.3 Receiving Water Sampling

Grab samples only were collected from the receiving water. The sample collection schedule was set based on the expected occurrence of the parameter groups and is summarized in Table 3.2. It should be noted that for the organochlorine and chlorobenzene test groups only two samples were

TABLE 3.2: RECEIVING WATER SAMPLE COLLECTION SUMMARY

Station	OC	CB	CP	PA	RFA	SP	VOL	PAH	MET
A	+	+	+	+	+	+	+		+
B	+	+	+	+	+	+	+		+
D	+	+	+	+	+	+	+		+
G	+	+	+	+	+	+	+		+
H	+	+			+	+	+		+
I	+	+			+	+	+		+
J	+	+			+	+	+		+
L	+	+			+	+	+		+
M	+	+			+	+	+		+
N	+	+			+	+	+		+
O	+	+			+	+	+		+
P	+	+			+	+	+		+

OC - Organochlorine
CB - Chlorobenzene
CP - Chlorinated Phenols
PA - Phenoxy Acids
RFA - Resin, Fatty & Aromatic Acids
SP - Speciated Phenolics
VOL - Volatiles
PAH - Polynuclear Aromatic Hydrocarbons
MET - Trace Metals

collected at the identified stations; once at the start and once at the end of the toxic organic and inorganic sampling runs.

As with the effluent sampling, the receiving water sampling for the toxic organic and inorganic test groups overlapped with the waste assimilation sampling which covered a 72-hour period. Samples were collected every 8 hours and covered the later 44 hours of the waste assimilation sampling. As can be seen in Table 3.2, several stations identified in Figure 3.1 were not sampled. No samples were collected at stations C, E, F and N in order to reduce the number of samples for analysis.

4.0 EFFLUENT CHARACTERIZATION

As part of the MISA pilot site study, several data collection surveys were planned and carried out as described earlier. Effluent characterization surveys were conducted to determine the quality, quantity and variability of the effluent of the major dischargers to the lower Kaministiquia River. The major emphasis of the sampling program was placed on the discharges from the CPFP company. Due to the proximity of RC Limited to CPFP, intensive sampling was also conducted.

In addition to the MISA pilot site sampling program, several other programs have collected and continue to collect effluent data. These include the ongoing industrial monitoring program, regional surveys and the MISA pre-regulation screening. Only the data collected as part of the pilot site work was included in this report.

The 1986 average monthly flows for the four major point source dischargers to the lower Kaministiquia River are listed in Table 4.1. Average daily flows for the August 1986 intensive survey are also included.

It is evident that in terms of flow volume the CPFP and the STP are the major contributors to the lower river. Average daily flows during the August 1986 intensive survey generally represent the annual monthly average with the exception of Ogilvie Mills.

Effluent quality results will be presented by major discharger. Up to 129 parameters were measured at each discharge point. A hierarchal screening approach was used to reduce the number of parameters to those of significance for each discharger. The first level of screening was based on a detection or non-detection. Non-detected parameters can generally be excluded from further analysis, the exception being for cases where the detection limit is greater than a specified objective. In these instances the parameter was identified as requiring developmental work in lowering the detection limit. Receiving water objectives were generally drawn from the Provincial Water Quality Objectives (PWQO) (MOE, 1984). Those

TABLE 4.1: EFFLUENT FLOW RATES - 1986

Month	CPFP	RC	OM	STP
January	2.31	0.0042	0.012	0.92
February	1.97	0.0047	0.012	0.82
March	1.97	0.0036	0.011	0.95
April	2.31	0.0028	0.012	1.44
May	2.89	0.0045	0.012	1.28
June	2.78	0.0041	0.012	1.13
July	2.89	0.0042	0.011	1.11
August	2.89	0.0042	0.012	1.10
September	2.66	0.0048	0.012	1.07
October	2.66	0.0043	0.013	1.04
November	2.31	0.0041	0.012	1.02
December	2.31	0.0038	0.011	0.92
Annual Average	2.50	0.0041	0.012	1.07
Average - Intensive Survey	2.95	0.0040	0.008	1.11

All Flows in m^3/s

CPFP = Canadian Pacific Forest Products
RC = Reichhold Chemical
OM = Ogilvie Mills
STP = Thunder Bay Sewage Treatment Plant

parameters for which there are no PWQOs were assigned objectives from other sources (CCREM 1987, Michigan 1984) where available.

The second level of screening utilized an arbitrary level of detection frequency to divide the detected parameters into frequently and infrequently detected groups. Detected parameters were also compared to receiving water criteria. Receiving water criteria do not apply directly to effluent concentrations; however, if a parameter has been detected at levels below the objective, then no receiving water concerns are likely to develop for that parameter. Possible exceptions to this include persistent bioaccumulative substances.

Detailed statistical analysis of effluent monitoring results was limited due to the limited number of samples collected. Temporal changes in effluent quality throughout the year could not be assessed as samples were collected within a one week period. Also, with generally only 14 samples per discharge point (7 grab samples plus 7 - 24 hour composites) the level of confidence that can be attached to effluent load estimates was limited.

4.1 The Canadian Pacific Forest Products Company

Plant process wastes are discharged through a submerged diffuser to the Kaministiquia River. A separate cooling water discharge also exists. The intensive sampling program carried out in August 1986 sampled both outfalls. Routine sampling programs generally provide results for a total combined discharge.

Screening results, lumped together for both outfalls and all samples are outlined in Tables 4.2 to 4.4. Parameters that were never detected, which total 66 are listed in Table 4.2. These parameters are generally not expected to occur in pulp and paper mill effluents, and those parameters that have no criteria or for which the detection limit is greater than the criteria (33 parameters) should be given a low priority for developmental work. The remaining 33 parameters, for which the detection limit is less

TABLE 4.2: CPFP 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS

Parameter	No. of Samples	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)			
PCB	14	20.0	1.0
Hexachlorobenzene	14	1.0	6.5
Aldrin	14	1.0	1.0
Mirex	14	5.0	1.0
α-BHC	14	1.0	10.0
β-BHC	14	1.0	10.0
ɣ-BHC	14	1.0	10.0
α-chlordane	14	2.0	60.0
Oxychlordane	14	2.0	-
pp-DDT	14	5.0	3.0
pp-DDE	14	1.0	3.0
DMDT Methoxychlor	14	5.0	40.0
Heptachlorepoxide	14	1.0	1.0
Endosulfan I	14	2.0	3.0
Endosulfan II	14	4.0	3.0
Endosulfan Sulphate	14	4.0	3.0
Octachlorostyrene	14	1.0	-
Chlorobenzenes (ng/l)			
Hexachloroethane	14	1.0	13000[3]
1,3,5 Trichlorobenzene	14	2.0	650
1,2,4 Trichlorobenzene	14	2.0	500
Hexachlorobutadiene	14	1.0	100[2]
1,2,3 Trichlorobenzene	14	2.0	900
2,4,5 Trichlorotoluene	14	1.0	-
2,3,6 Trichlorotoluene	14	1.0	-
1,2,3,5 Tetrachlorobenzene	14	1.0	100
1,2,4,5 Tetrachlorobenzene	14	1.0	150
1,2,3,4 Tetrachlorobenzene	14	1.0	100
Pentachlorobenzene	14	1.0	30
Chlorinated Phenols (ng/l)			
2,3,4 Trichlorophenol	30	100.0	18000
Phenoxy Acids (ng/l)			
Dicamba	15	100.0	200000
Silvex	15	50.0	3000[3]
Picloram	15	100.0	-
Fatty Acids (ug/l)			
Lauric	29	10.0	-

TABLE 4.2: CPFP 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Speciated Phenolics (ug/l)			
Acetosyringone	6	1.0	-
Volatiles (ug/l)			
1,2 Dichloroethylene	30	0-20.0	-
1,1 Dichloroethane	30	0-20.0	-
1,2 Dichloroethane	30	0-20.0	560[3]
1,1,1 Trichloroethane	30	0-20.0	120[3]
Benzene	30	0-20.0	300[2]
Trichloroethylene	30	0-20.0	94[3]
Toluene	30	0-20.0	300[2]
1,1,2 Trichloroethane	30	0-20.0	-
Tetrachloroethylene	30	0-20.0	260[2]
Chlorobenzene	30	0-20.0	71[3]
Trifluorochlorotoluene	13	1.0-10.0	-
Ethylene Dibromide	15	1.0-10.0	-
O-xylene	30	0-20.0	-
1,1,2,2 Tetrachloroethane	30	0-20.0	-
1,3 Dichlorobenzene	30	0-20.0	2.5
1,2 Dichlorobenzene	30	0-20.0	2.5
PAH (ng/l)			
Pyrene	7	0	-
Benz (A) Anthracene	7	0	-
Chrysene	7	0	-
Dimeth. Benz (A) Anthracene	7	0	-
Benzo (E) Pyrene	7	0	-
Benzo (J) Fluoranthene	7	0	-
Benzo (B) Fluoranthene	7	0	-
Benzo (K) Fluoranthene	7	0	-
Perylene	7	0	-
Benzo (A) Pyrene	7	0	10.0[2]*
Benzo (G,H,I) Perylene	7	0	-
Dibenz (A,H) Antracene	7	0	-
Indeno (1,2,3 - C,D) Pyrene	7	0	-
Benzo (B) Chrysene	7	0	-
Metals (mg/l)			
Beryllium	27	0.01-0.05	0.011
Cobalt	29	0.01-0.10	-

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
- No Criteria
* Drinking Water Objective

TABLE 4.3: CPFP 1986 EFFLUENT SAMPLING RESULTS - INFREQUENTLY DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)					
Heptachlor	15	1	37	1.0	1.0
ɣ-Chlordane	15	3	2-95	2.0	60.0
op-DDT	15	1	70	5.0	3.0
pp-DDD	15	3	5-80	5.0	3.0
Dieldrin	15	1	14	2.0	1.0
Endrin	15	1	4	4.0	2.0
Chlorobenzenes (ng/l)					
2,6,a Trichlorotoluene	15	2	11-91	1.0	-
Chlorinated Phenols (ng/l)					
2,4,5 Trichlorophenol	30	2	850-26,000	50.0	18,000
2,3,5,6 Tetrachlorophenol	30	1	60	50.0	1,000
2,3,4,5 Tetrachlorophenol	30	1	210	50.0	1,000
Phenoxy Acids (ng/l)					
2,4 Dichlorophenoxyacetic	15	1	200	100.0	4,000
2,4,5 Trichlorophenoxyacetic	15	1	140	50.0	-
2,4,D Propionic Acid	15	1	460	100.0	-
2,4 Dichlorophenoxybutyrc	15	1	2,130	200.0	-
Fatty Acids (ug/l)					
Capric	29	2	17- 30	10.0	-
Myristic	29	5	10- 15	10.0	-
Oleic/Linoleic	29	6	31-326	10.0	-
Aromatic Acids (ug/l)					
Salicylic	29	5	863-1,400	10.0	-
Phthalic	29	1	32	10.0	-
Speciated Phenolics (ug/l)					
Phenol	6	2	3-16	1.0	1.0
Vanillin	6	2	2- 8	1.0	-
Homovanillic Acid	6	1	8	1.0	-
Guaicol	6	1	7	1.0	-
Syringaldehyde	6	1	3	1.0	-
Aceto vanillone	6	1	10	1.0	-

TABLE 4.3: CPFP 1986 EFFLUENT SAMPLING RESULTS - INFREQUENTLY DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
Volatiles (ug/l)					
1,1 Dichloroethylene	30	1	2	1.0-20.0	3[3]
Carbontetrachloride	30	2	1- 2	1.0-20.0	27[3]
Chlorodibromomethane	30	1	1	1.0-20.0	350*
Ethylbenzene	30	1	54	1.0-20.0	700[2]
M & P Xylenes	30	2	12-242	1.0-20.0	40[3]
Bromoform	30	1	2	1.0-20.0	1,500[4]
1,4 Dichlorobenzene	30	9	11-313	1.0-20.0	4
PAH (ng/l)					
Phenanthrene	7	1	10- 50	0	-
Anthracene	7	1	1- 5	0	-
Fluoranthene	7	1	2- 10	0	-
Metals (mg/l)					
Cadmium	29	1	0.003	0.001-0.01	0.0002
Copper	29	4	0.02-0.28	0.01 -0.10	0.005
Nickel	29	1	0.02	0.01 -0.10	0.025
Lead	29	2	0.01-0.02	0.01 -0.10	0.020
Vanadium	27	1	0.02	0.01 -0.10	-

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
[4] Ontario Advisory
- No Criteria
* Drinking Water Objective

TABLE 4.4: CPFP 1986 EFFLUENT SAMPLING RESULTS - FREQUENTLY DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
Chlorinated Phenols (ng/l)					
2,4,6 Trichlorophenol	30	28	120-30,000	50.0	18,000
Pentachlorophenol	29	14	50-44,000	50.0	500
Fatty Acids (ug/l)					
Palmitic	29	17	11- 50	10.0	-
Stearic	29	14	10-190	10.0	-
Arachidic	29	8	12- 30	10.0	-
Aromatic Acids (ug/l)					
Benzoic	29	13	26-125	10.0	-
Resin Acids (ug/l)					
Pimaric	29	14	43- 120	10.0	-
Sandaracopimaric	29	14	52- 150	10.0	-
Palustric/Levopimaric	29	14	96- 685	10.0	-
Isopimaric	29	17	11- 300	10.0	-
Neoabietic	29	16	24- 500	10.0	-
Abietic	29	14	130-4,850	10.0	-
Dehydroabietic	29	14	29-1,270	10.0	8.0[5]
Volatiles (ug/l)					
Dichloromethane	30	22	2- 120	0-20.0	5,000[4]
Chloroform	30	28	65-7,060	0-20.0	1,200[4]
Dichlorobromomethane	30	14	7- 14	0-20.0	-
Metals (mg/l)					
Iron	29	29	0.21-3.90		0.30
Manganese	27	26	0.01-1.10	0.01-0.10	0.05*
Aluminum	29	27	0.11-8.20	0.10-1.00	0.10[2]
Chromium	29	26	0.11-2.10	0.01-0.10	0.10
Mercury** (ug/l)	29	29	0.01-0.43		0.2**
Strontium	27	26	0.03-0.35	0.01-0.05	-
Zinc	29	16	0.01-0.20	0.01-0.10	0.030

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
[4] Ontario Advisory
[5] Provincial Water Quality Guideline for pH = 7
- No Criteria
* Drinking Water Objective
** Sample results are unfiltered, criteria applicable to filtered results

than the criteria, require no further analysis.

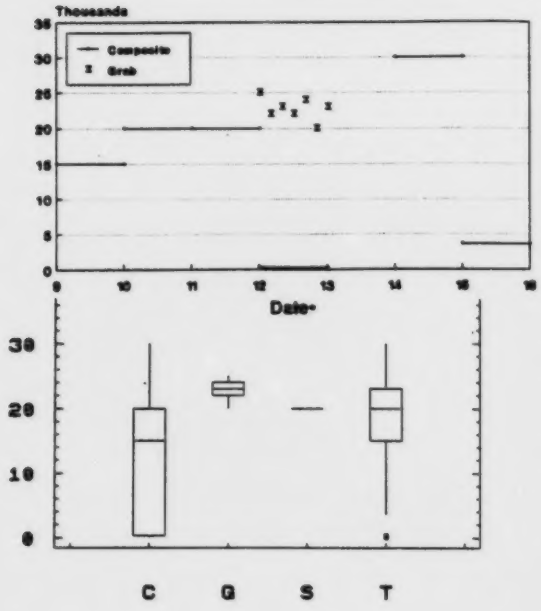
The next level of screening uses an arbitrary level of detection frequency to divide the data set between infrequently and frequently detected parameters. The level has been set at 50% for each outfall. With two outfalls and the expectation that a particular parameter will likely occur in only one or the other outfall, the screening criteria becomes 25%. Table 4.3 lists 40 parameters that were detected infrequently. Ten parameters were detected below criteria levels and require no further analysis. No criteria are available for 18 of the parameters. These parameters should be given a lower priority for developmental work. The remaining twelve parameters will not be examined in detail in this section but will be included in further analysis as part of the next chapter which examines receiving water impacts. Six of these twelve parameters also have a detection limit above criteria levels and should also be given a lower priority for development work.

Twenty-three frequently detected parameters are listed in Table 4.4. No criteria are available for 12 of the parameters. Criteria development work should be given higher priority for these parameters. The single parameter for which the detected concentrations are less than the criteria requires no further analysis. The remaining 10 parameters will be examined in detail. In addition to these 10 parameters, Total Resin Acids (TRA) will be included in the detailed analysis. TRA was not measured directly in the laboratory but has been determined as the arithmetic total of all the detections of resin acids for a specific sample.

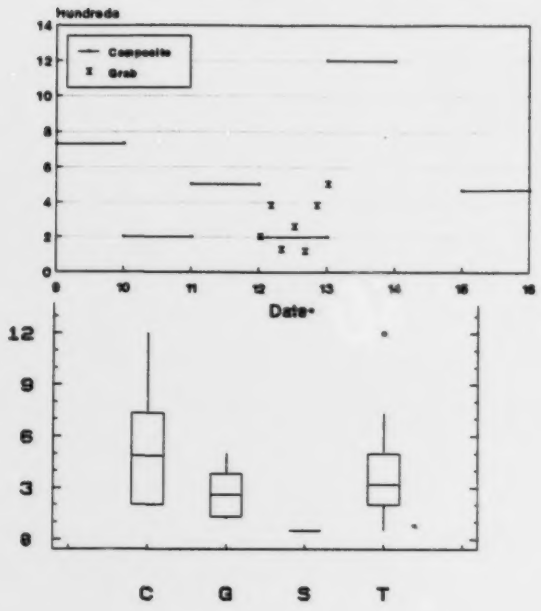
As outlined earlier, screening results listed in Tables 4.2 to 4.4 were lumped together for both outfalls and all samples. Differences in occurrences of specific parameters exist between the outfalls as well as between sampling strategies, either grab sample or composite. These differences will also be examined in the following sections.

Sample results for the 11 parameters to be examined in detail are presented in Figure 4.1. Results are split between the A and B outfalls and are

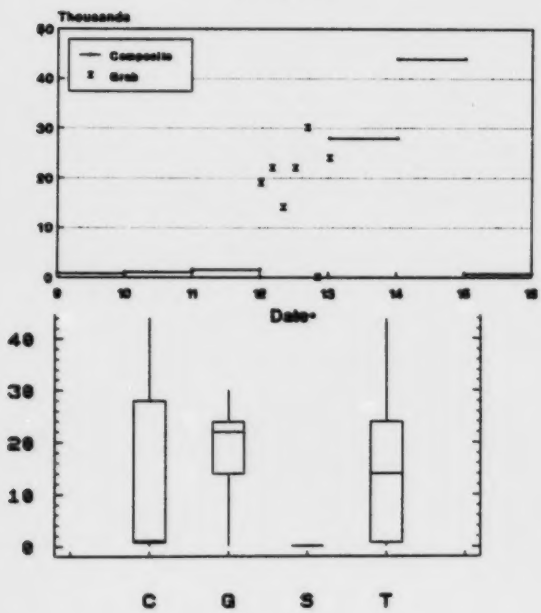
a) 2,4,6 Trichlorophenol (ng/l)
A outfall



b) 2,4,6 Trichlorophenol (ng/l)
B outfall



c) Pentachlorophenol (ng/l)
A outfall



d) Dehydroabietic Acid (ug/l)
A outfall

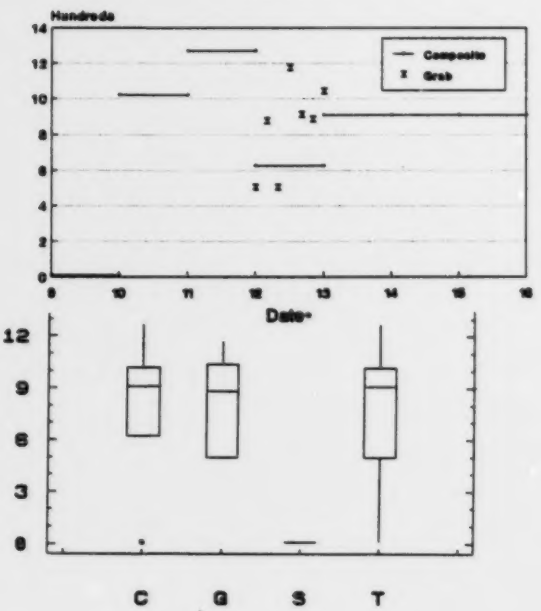
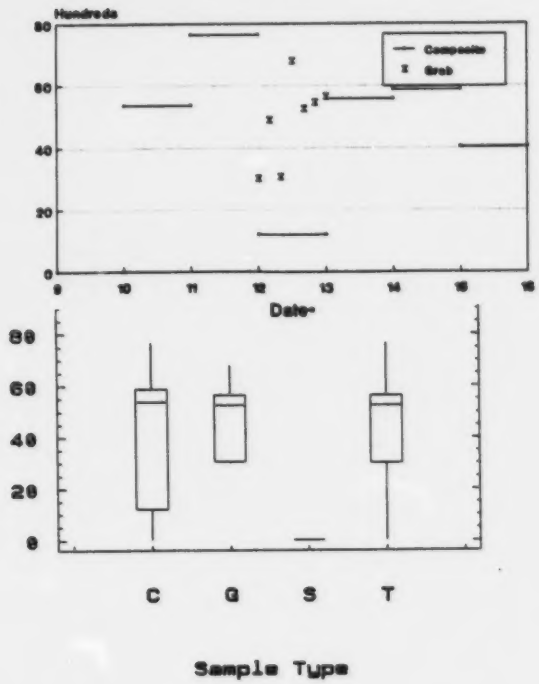


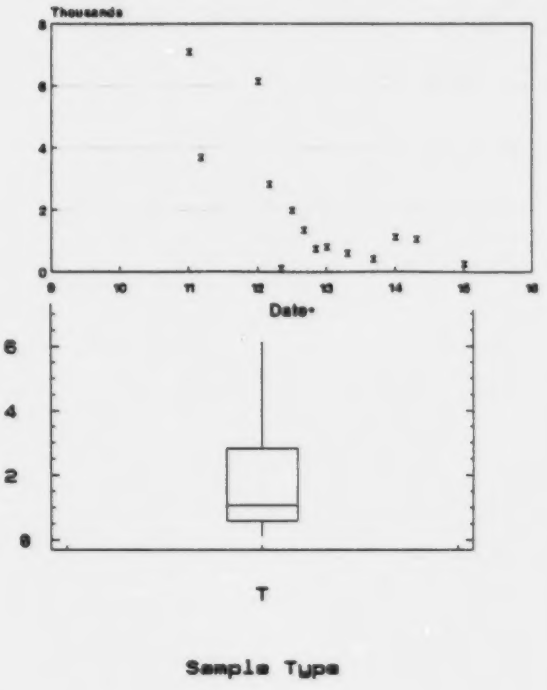
FIGURE 4:1 : CPFP Effluent Characterization

e) Total Resin Acids (ug/l)
A outfall



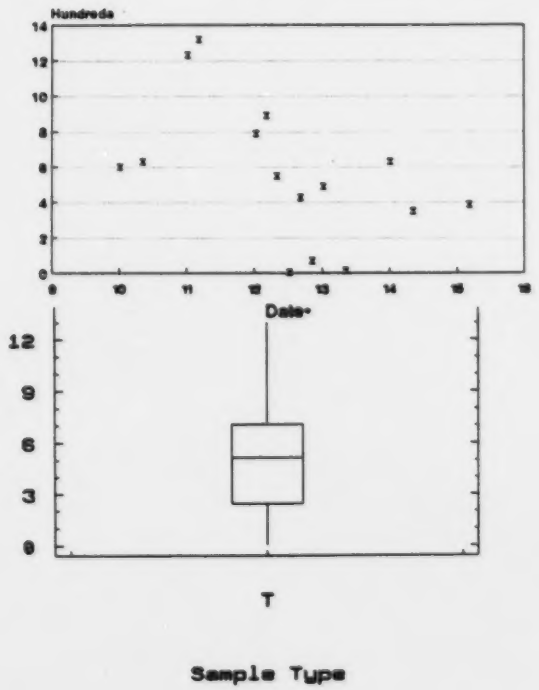
Sample Type

f) Chloroform (ug/l)
A outfall



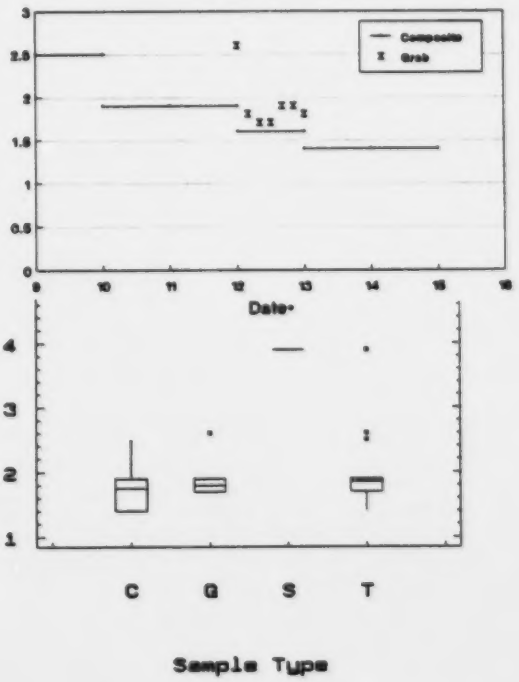
Sample Type

g) Chloroform (ug/l)
B outfall



Sample Type

h) Iron (mg/l)
A outfall



Sample Type

FIGURE 4:1 : CPFP Effluent Characterization (Continued)

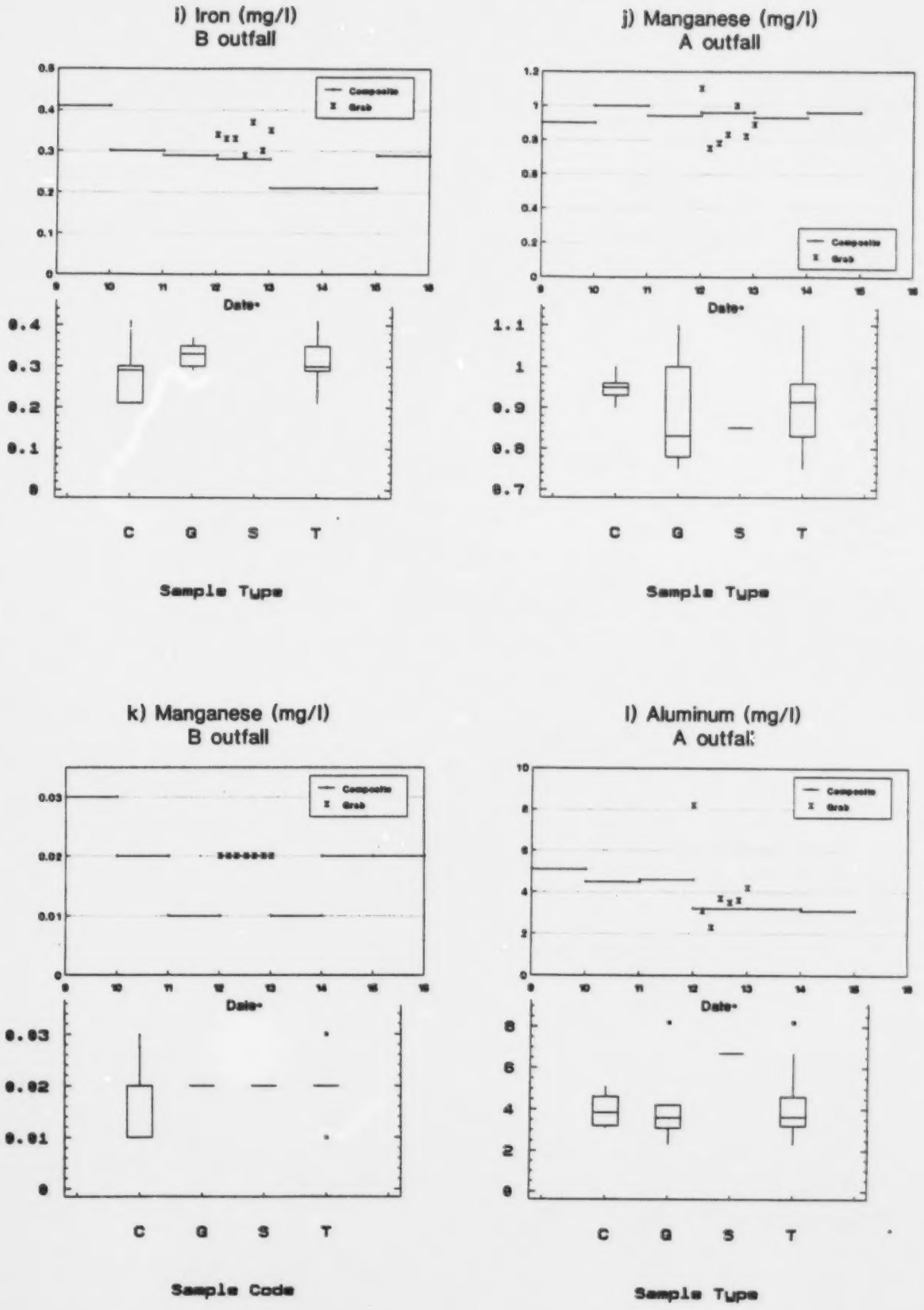
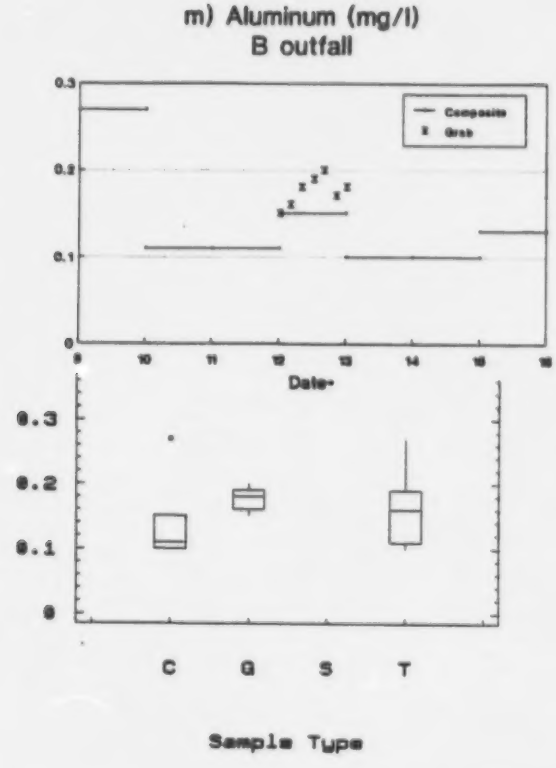
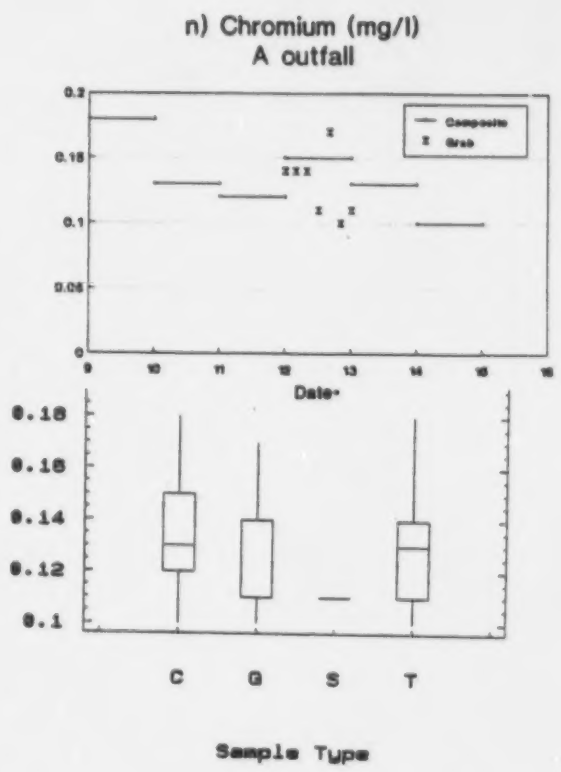
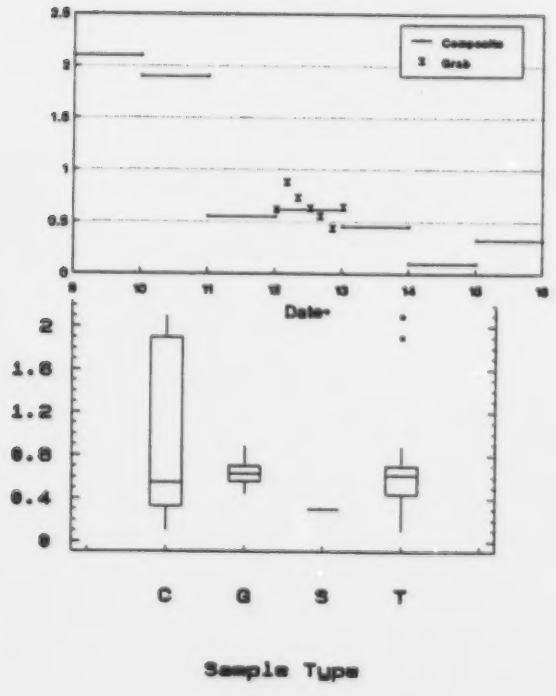


FIGURE 4:1 : CPFP Effluent Characterization (Continued)







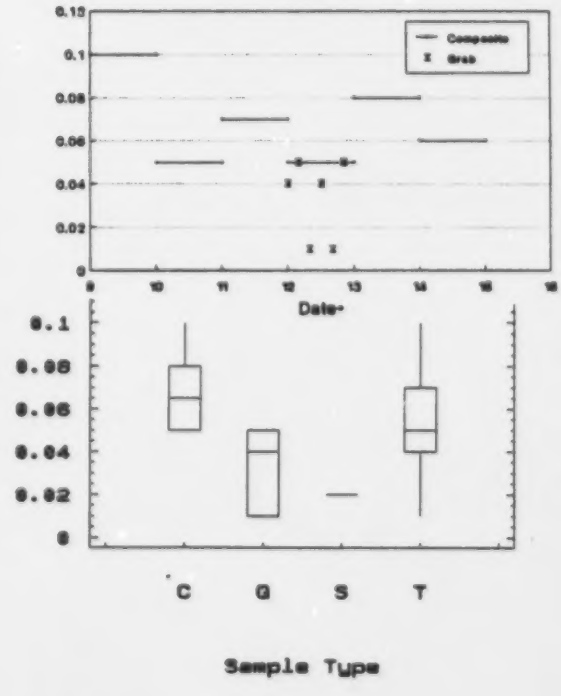
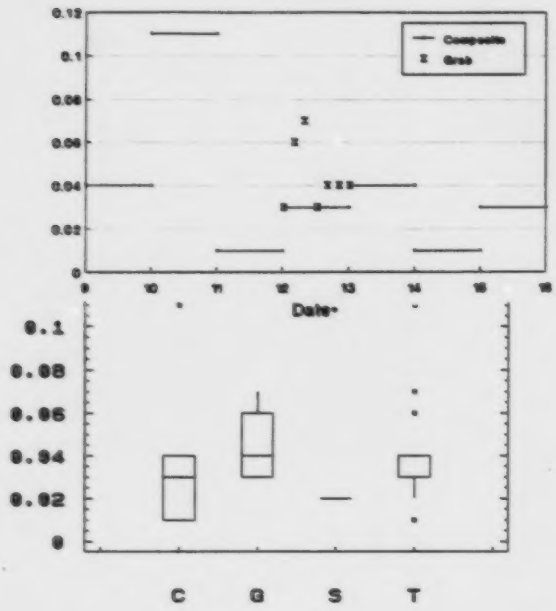
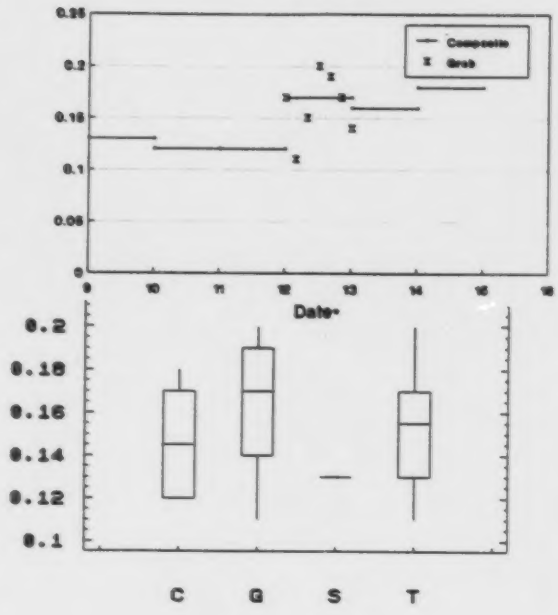


FIGURE 4:1 : CPFP Effluent Characterization (Continued)

q) Mercury (mg/l)
B outfall



r) Zinc (mg/l)
A outfall



* Time is 12:00 noon, August 1986, on date shown

Sample types are as follows:

C - Composite
G - Grab
S - Spring (grab)
T - Total (all samples)

FIGURE 4:1 : CPFP Effluent Characterization (Continued)

presented in a series of two graphs for each parameter for each outfall. The upper graph presents a time history of effluent quality including results of the 7 - 24 hour composites and the grab samples. The lower graph presents a data summary by sample type, composite or grab, and also includes results from a single grab sample collected in the spring of 1986. The last sample type in the lower graph is a summary plot containing all the sample results for the particular parameter for a particular outfall.

A Box and Whisker plotting technique has been utilized to summarize the data in the lower graphs of Figure 4.1. The technique is a graphical one which plots the 25th and 75th percentiles of the data as the limits of the box and adds the median, 50th percentile, within the box. The tails of the plot are drawn to the next adjacent value that is within 1½ times the inter-quartile range, the difference between the 75th and 25th percentile, of the limits of the box. Values beyond these limits are considered "outside values" and are plotted as points. For a complete description of the technique, see Chambers, et al., 1983. The following discussion relates to Figure 4.1 and presents results by parameter.

2,4,6 Trichlorophenol

The results show that generally, concentrations in the A outfall are 1 to 2 orders of magnitude greater than in the B outfall. For both outfalls the composite sample results show that day-to-day variations are large as compared to within day variations as represented by the grab sample results. It should be noted that for the B outfall the composite sample collected from noon August 14 to noon August 15 had a sample result of 14,000 ng/l and was not included in the plot due to scaling considerations. This level of sample result is comparable to results for the A outfall.

A comparison of the composite and grab sample results shows a poor correlation. While the grab sample results generally fall within the range of the composite results, a direct comparison of grab sample results collected during the time of the corresponding composite sample shows no correlation. There are many possible sources for this anomaly including

contamination during sample collection, contamination within the lab or the spoiling of the samples. Additionally, for the B outfall, it may be possible that spikes in concentration may have occurred in between the collection of the grab samples. For the A outfall one can only assume that there was a problem in analysing the composite sample (August 14 to August 15).

Pentachlorophenol

Pentachlorophenol was only infrequently detected in the B outfall. Two detections slightly above the detection limit. No further analysis was performed using the B outfall data.

Outfall A results show that pentachlorophenol occurs at low levels for a majority of the time with a few days of high levels. The grab sample results correlate poorly with the corresponding composite sample result.

DeHydroabietic Acid (DHA)

DHA was also only detected twice in the B outfall. Once at a level just above the detection limit and once at levels approaching those detected in the A outfall. No further analysis was performed using the B outfall data.

Results for outfall A show a good correlation between composite and grab sample results in general suggesting that similar levels of variability exists within a day as well as from day to day.

Total Resin Acids (TRA)

As described earlier TRA was determined as the sum of all detected resin acid concentrations. With DHA being a major component of TRA (15% to 45% of TRA), the behaviour of TRA is similar to DHA. The results show trends as described above.

Chloroform

Due to the nature of volatile organics, chloroform samples cannot be composited by machine. For this reason only grab samples were collected as described in Section 3.0. Figure 4.1 therefore contains the time series plot and a single box and whisker plot summarizing the data.

The results show that A outfall levels are up to an order of magnitude greater than B outfall levels. The degree of variability in A outfall results is also much larger than B outfall results as compared to their respective means.

Iron

The overall results show that A outfall results are approximately half an order of magnitude greater than B outfall results. Outfall A composite results appear to show a decreasing trend over the week of sampling.

Grab sample results and the corresponding composite sample result are poorly correlated for both outfalls. All grab sample results are greater than their corresponding composite sample result.

Manganese

Outfall A results are up to two orders of magnitude greater than the B outfall results. The A outfall composite results show little day-to-day variability while the grab samples show a much greater variability. The B outfall results have almost no variability with most values marginally above the detection limit.

The grab sample results and the corresponding composite sample result show a good level of agreement.

Aluminum

Similar levels of variability for the grab samples and composite samples

exist within each of the outfall results. Outfall A shows a good level of correlation between the grab sample results and the corresponding composite sample. Outfall B results show a poor correlation.

Outfall A results are more than an order of magnitude greater than B outfall results.

Chromium

Chromium is the single parameter for which outfall B results are greater than the A outfall results. Outfall A results show a small degree of variability and a good correlation between the grab sample results and the corresponding composite sample.

B outfall results show a much larger day-to-day variability than a within day variability. Grab sample results for the B outfall show a good level of correlation with the corresponding composite sample.

Mercury

Both outfalls exhibited similar levels of mercury discharge. The degree of variability relative to the means is low for both outfalls. Outfall B shows a good correlation between the grab sample results and the corresponding composite sample, while outfall A does not.

It should be noted that sample results are for unfiltered samples while the PWQO applies to filtered samples. Additionally, however, mercury is listed in Table 2 of the Blue Book (MOE, 1984) as a substance with a zero tolerance limit. CPFP draws their water supply from the Kaministiquia River which may be a source for the mercury. Background water quality is examined as part of the next section.

A single grab sample result for the A outfall of 0.43 ug/l has not been included in Figure 4.1.

Zinc

Zinc was detected only twice in the B outfall at the detection level. No analysis could therefore be performed.

Outfall A results show a significant amount of variability both from day to day and within day. Grab sample results show a good correlation with the corresponding composite sample.

Composite versus Grab Sample

A comparison of the average grab sample result with the corresponding composite value is presented in Table 4.5. It is difficult to make a comparison as non-flow-proportioned composite samples were collected and information on flow variability within a day is unavailable. An examination of daily reported flow levels (Murphy, 1988), however, shows less than a 10% change in A outfall discharge and no change in the B outfall discharge. With such a large integrated facility it is assumed that the day-to-day fluctuations are representative of within day variations.

Assuming that the within day flow variations are small, a straight arithmetic average of the grab sample results was calculated. Results for the trace metal contaminants and dehydroabietic acid are in good agreement. 2,4,6 Trichlorophenol and Total Resin Acids show a very poor agreement. A comparison for Pentachlorophenol cannot be made.

Percentile values for the 11 parameters examined in detail in this section are presented in Table 4.6. The values are based on all the data collected, both grab and composite samples.

4.2 Reichhold Chemical Ltd.

The Reichhold Chemical plant produces formaldehyde for use in making urea formaldehyde resin and phenol formaldehyde resin which are sold as

TABLE 4.5: CPFP - GRAB VERSUS COMPOSITE SAMPLES

Parameter	OUTFALL A		OUTFALL B	
	Grab Sample Average	Composite	Grab Sample Average	Composite
2,4,6 Trichlorophenol (ng/l)	22,700	340	280	200
Pentachlorophenol (ng/l)	18,720	CS	-	-
Dehydroabietic Acid (ug/l)	840	625	-	-
Total Resin Acids (ug/l)	4850	1210	-	-
Iron (mg/l)	1.91	1.60	0.33	0.28
Manganese (mg/l)	0.88	0.96	0.02	0.02
Aluminum (mg/l)	4.09	3.20	0.18	0.15
Chromium (mg/l)	0.13	0.15	0.64	0.62
Mercury* (ug/l)	0.09	0.05	0.04	0.03
Zinc (mg/l)	0.16	0.17	-	-

* Unfiltered samples
- Insufficient detections to perform calculations.
CS No Data, Contamination Suspected.

TABLE 4.6: CPFP EFFLUENT CONTAMINANT PERCENTILES

Parameter	Outfall	Percentiles				
		90	75	50	25	10
2,4,6 Trichlorophenol (ng/l)	A	25000	23000	20000	15000	340
	B	730	500	320	200	120
Pentachlorophenol (ng/l)	A	30000	24000	14000	700	<50
	B	-	-	-	-	-
Dehydroabietic Acid (ug/l)	A	1170	1020	910	500	<10
	B	-	-	-	-	-
Total Resin Acids (ug/l)	A	6760	5625	5238	3000	10
	B	145	32	10	10	10
Chloroform (ug/l)	A	6130	2813	1071	584	244
	B	1226	707	514	246	<10
Iron (mg/l)	A	2.6	1.9	1.85	1.7	1.4
	B	0.41	0.35	0.30	0.29	0.21
Manganese (mg/l)	A	1.0	0.96	0.92	0.83	0.78
	B	0.02	0.02	0.02	0.02	<0.01
Aluminum (mg/l)	A	6.70	4.60	3.65	3.20	3.10
	B	0.27	0.19	0.16	0.11	<0.10
Chromium (mg/l)	A	0.17	0.14	0.13	0.11	<0.10
	B	1.9	0.70	0.62	0.44	0.30
Mercury* (ug/l)	A	0.10	0.07	0.05	0.04	0.01
	B	0.07	0.04	0.04	0.03	0.01
Zinc (mg/l)	A	0.19	0.17	0.16	0.13	0.12
	B	-	-	-	-	-

* Unfiltered samples
\- Insufficient detections to perform calculations

adhesives for plywood and other wood products. Effluent is discharged via a bank outfall. The company is currently seeking approval to allow it to discharge to the sanitary sewer system thus removing it as a point source discharger to the lower Kaministiquia River.

As shown in Table 4.1, Reichhold Chemical has a discharge volume three orders of magnitude smaller than that of CPFP. As described earlier only 24-hour composite samples were collected at Reichhold. The same list of parameters analysed for CPFP were analysed for Reichhold effluent.

Sampling results are summarized in Tables 4.7 to 4.9. Parameters that were not detected, which total 108, are listed in Table 4.7. Fifty-seven parameters have no criteria or a detection limit which is greater than the criteria and should be given a low priority for developmental work. The remaining parameters, 51 in total, for which the detection limit is less than the criteria, require no further analysis.

For the secondary dischargers, Reichhold Chemical, Ogilvie Mills and the Sewage Treatment Plant, the next level of screening to divide the dataset between frequently and infrequently detected parameters has been set at 25% due to the smaller number of samples collected. Parameters that were infrequently detected are listed in Table 4.8. All 5 parameters had detection limits that were less than the corresponding criteria. Three of the parameters had detected levels above criteria levels. Pentachlorophenol was significantly above the criteria and should be included in any future monitoring program. The remaining two parameters detected above criteria levels, aluminum and chromium, should also be included in future monitoring programs. While it may appear that the trace metals have occurred infrequently, the detections occurred for the single sample that had the lower detection level.

Frequently detected parameters are listed in Table 4.9. Eleven parameters have no applicable screening criteria and should be given higher priority for developmental work. Detected concentrations for four of the parameters were below criteria levels and require no further analysis. It should be

TABLE 4.7: REICHHOLD CHEMICAL 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS

Parameter	No. of Samples	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)			
PCB	7	20.0	1.0
Hexachlorobenzene	7	1.0	6.5
Heptachlor	7	1.0	1.0
Aldrin	7	1.0	1.0
pp-DDE	7	1.0	3.0
Mirex	7	5.0	1.0
α-BHC	7	1.0	10.0
β-BHC	7	1.0	10.0
γ-BHC	7	1.0	10.0
α-chlordane	7	2.0	60.0
γ-chlordane	7	2.0	60.0
Oxychlordane	7	2.0	-
op-DDT	7	5.0	3.0
pp-DDD	7	5.0	3.0
pp-DDT	7	5.0	3.0
DMDT Methoxychlor	7	5.0	40.0
Heptachlorepoxide	7	1.0	1.0
Endosulfan I	7	2.0	3.0
Endosulfan II	7	4.0	3.0
Dieldrin	7	2.0	1.0
Endrin	7	4.0	2.0
Endosulfan Sulphate	7	4.0	3.0
Octachlorostyrene	7	1.0	-
Chlorobenzenes (ng/l)			
Hexachloroethane	7	1.0	13000[3]
1,3,5 Trichlorobenzene	7	2.0	650
1,2,4 Trichlorobenzene	7	2.0	500
Hexachlorobutadiene	7	1.0	100[2]
1,2,3 Trichlorobenzene	7	2.0	900
2,4,5 Trichlorotoluene	7	1.0	-
2,3,6 Trichlorotoluene	7	1.0	-
1,2,3,5 Tetrachlorobenzene	7	1.0	100
1,2,4,5 Tetrachlorobenzene	7	1.0	150
2,6a Trichlorotoluene	7	1.0	-
1,2,3,4 Tetrachlorobenzene	7	1.0	100
Pentachlorobenzene	7	1.0	30

TABLE 4.7: REICHHOLD CHEMICAL 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Chlorinated Phenols (ng/l)			
2,4,5 Trichlorophenol	7	50.0	18000[2]
2,3,4 Trichlorophenol	7	100.0	18000[2]
2,3,5,6 Tetrachlorophenol	7	50.0	1000[2]
2,3,4,5 Tetrachlorophenol	7	50.0	1000[2]
Phenoxy Acids (ng/l)			
Dicamba	7	100.0	200000
Silvex	7	50.0	3000[3]
2,4 Dichlorophenoxybutyrc	7	200.0	-
Picloram	7	100.0	-
Fatty Acids (ug/l)			
Capric	7	10.0	-
Myristic	7	10.0	-
Arachidic	7	10.0	-
Aromatic Acids (ug/l)			
Benzoic	7	10.0	-
Salicylic	7	10.0	-
Phthalic	7	10.0	-
Resin Acids (ug/l)			
Pimaric	7	10.0	-
Sandaracopimaric	7	10.0	-
Palustric/Levopimaric	7	10.0	-
Isopimaric	7	10.0	-
Neoabietic	7	10.0	-
Abietic	7	10.0	-
Dehydroabietic	7	10.0	8.0[4]
Speciated Phenolics (ug/l)			
Phenol	2	1.0	1.0
Vanillin	2	1.0	-
Homovanillic Acid	2	1.0	-
Guaicol	2	1.0	-
Syringaldehyde	2	1.0	-
Aceto vanillone	2	1.0	-
Aceto syringone	2	1.0	-

TABLE 4.7: REICHHOLD CHEMICAL 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Volatiles (ug/l)			
1,1 Dichloroethylene	10	1.0-10.0	3[3]
1,2 Dichloroethylene	10	1.0-10.0	-
1,1 Dichloroethane	10	1.0-10.0	-
1,1,1 Trichloroethane	10	1.0-10.0	120[3]
1,2 Dichloroethane	10	1.0-10.0	560[3]
Carbontetrachloride	10	1.0-10.0	27[3]
Benzene	10	1.0-10.0	300[2]
Trichloroethylene	10	1.0-10.0	94[3]
Dichlorobromomethane	10	1.0-10.0	-
Toluene	10	1.0-10.0	300[2]
1,1,2 Trichloroethane	10	1.0-10.0	-
Chlorodibromomethane	10	1.0-10.0	350*
Tetrachloroethylene	10	1.0-10.0	260[2]
Chlorobenzene	10	1.0-10.0	71[3]
Trifluorochlorotoluene	10	1.0-10.0	-
Ethylbenzene	10	1.0-10.0	700[2]
Ethylene Dibromide	10	1.0-10.0	-
M & P Xylenes	10	1.0-10.0	40[3]
Bromoform	10	1.0-10.0	350*
O-xylene	10	1.0-10.0	-
1,1,2,2 Tetrachloroethane	10	1.0-10.0	-
1,4 Dichlorobenzene	10	1.0-10.0	4
1,3 Dichlorobenzene	10	1.0-10.0	2.5
1,2 Dichlorobenzene	10	1.0-10.0	2.5
PAH (ng/l)			
Anthracene	4	0.0	-
Benz (A) Anthracene	4	0.0	-
Chrysene	4	0.0	-
Dimeth. Benz (A) Anthracene	4	0.0	-
Benzo (E) Pyrene	4	0.0	-
Benzo (J) Fluoranthene	4	0.0	-
Benzo (B) Fluoranthene	4	0.0	-
Perylene	4	0.0	-
Benzo (K) Fluoranthene	4	0.0	-
Benzo (A) Pyrene	4	0.0	10[2]*
Benzo (G,H,I) Perylene	4	0.0	-
Dibenz (A,H) Anthracene	4	0.0	-
Indeno (1,2,3-C,D) Pyrene	4	0.0	-

TABLE 4.7: REICHHOLD CHEMICAL 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Metals (mg/l)			
Beryllium	7	0.01 -0.5	0.011
Cadmium	7	0.001-0.01	0.0002
Cobalt	7	0.01 -0.10	0.005
Copper	7	0.01 -0.10	-
Nickel	7	0.01 -0.10	0.025
Lead	7	0.01 -0.10	0.020
Vanadium	7	0.01 -0.10	-
Zinc	7	0.01 -0.10	0.030

1 All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
2 CCREM
3 Michigan
4 Provincial Water Quality Guideline for pH = 7.
- No Criteria
* Drinking Water Objective

TABLE 4.8: REICHHOLD CHEMICAL 1986 EFFLUENT SAMPLING RESULTS - INFREQUENTLY DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Level	Detection Limit	Criteria[1]
Chlorinated Phenols (ng/l)					
Pentachlorophenol	7	1	20000	50	500
Volatiles (ug/l)					
Chloroform	10	1	110	1-10	1200
Metals (mg/l)					
Manganese	7	1	0.02	0.01-0.10	0.05*
Aluminum	7	1	0.15	0.10-1.0	0.10[2]
Chromium	7	1	0.61	0.01-0.10	0.10

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
* Drinking Water Objective

TABLE 4.9: REICHHOLD CHEMICAL 1986 EFFLUENT SAMPLING RESULTS - FREQUENTLY DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Level	Detection Limit	Criteria[1]
Chlorinated Phenols (ng/l)					
2,4,6 Trichlorophenol	7	4	300-1500	50	18000[2]
Phenoxy Acids (ng/l)					
2,4,D Propionic Acid	7	2	300-690	100	-
2,4 Dichlorophenoxyacetic	7	3	200-390	100	4000
2,4,5 Trichlorophenoxyacetic	7	2	100-640	50	-
Fatty Acids (ug/l)					
Lauric	7	2	11- 12	10	-
Palmitic	7	5	14- 34	10	-
Stearic	7	5	16- 36	10	-
Oleic/Linoleic	7	6	222-700	10	-
Volatiles (ug/l)					
Dichloromethane	10	8	25- 80	1-10	5000
PAH (ng/l)					
Phenanthrene	4	1	60-300	0	-
Fluoranthene	4	1	20-100	0	-
Pyrene	4	1	10- 50	0	-
Benzo (B) Chrysene	4	1	10- 50	0	-
Metals (mg/l)					
Iron	7	7	0.18-0.31	0.01-0.10	0.30
Mercury** (ug/l)	7	6	0.01-0.04		0.20**
Strontium	7	2	0.03-0.05	0.01-0.05	-

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
- No Criteria
** Sample results are unfiltered, criteria applies to filtered results.

noted, however, that the criteria for Mercury applies to filtered results while the sample results summarized in Table 4.9 are for unfiltered samples. Additionally, mercury is listed as a zero tolerance parameter in the Blue Book (MOE, 1984) for which discharge levels should be zero. Further sampling of Reichhold Chemical including the source water is required to determine the source and actual magnitude of mercury in a filtered sample.

The remaining single parameter, Iron, had only a single detection marginally above the criteria and also need not be examined in detail.

4.3 Ogilvie Mills

Process wastewaters from Ogilvie Mills Limited are discharged via a bank outfall. Table 4.1 shows that relative to CPFP, Ogilvie Mills is also a minor discharger in terms of flow volume. As described in Section 3.0, only three 24-hour composite samples were collected. The list of parameters analysed for Ogilvie Mills was the same as that for CPFP.

Sampling results are outlined in Tables 4.10 and 4.11. Parameters that were not detected are listed in Table 4.10. Fifty-two parameters had a detection limit greater than the criteria or no criteria and should be given a low priority for developmental work. The remaining 43 parameters that have a detection limit less than the criteria require no further analysis.

With only three 24-hour composites collected for Ogilvie Mills, there is no need for a further screening between frequently and infrequently detected parameters. The remaining sample parameters listed in Table 4.11, 27 in total, will only be used to indicate the possible presence of a parameter.

Ten parameters have no applicable screening criteria and should be given a higher priority for developmental work. Detected levels of six of the parameters were below criteria values and require no further analysis. The remaining 11 parameters, which were detected above criteria levels, will be

TABLE 4.10: OGILVIE MILLS 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS

Parameter	No. of Samples	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)			
PCB	3	20.0	1.0
Hexachlorobenzene	3	1.0	6.5
Aldrin	3	1.0	1.0
Mirex	3	5.0	1.0
α-BHC	3	1.0	10.0
β-BHC	3	1.0	10.0
ɣ-BHC	3	1.0	10.0
α-chlordane	3	2.0	60.0
Oxychlordane	3	2.0	-
op-DDT	3	5.0	3.0
pp-DDT	3	5.0	3.0
DMDT Methoxychlor	3	5.0	40.0
Heptachlorepoxide	3	1.0	1.0
Endosulfan I	3	2.0	3.0
Endosulfan Sulphate	3	4.0	3.0
Octachlorostyrene	3	1.0	-
Chlorobenzenes (ng/l)			
Hexachloroethane	3	1.0	13000
1,3,5 Trichlorobenzene	3	2.0	650
1,2,4 Trichlorobenzene	3	2.0	500
Hexachlorobutadiene	3	1.0	100
1,2,3 Trichlorobenzene	3	2.0	900
2,4,5 Trichlorotoluene	3	1.0	-
2,3,6 Trichlorotoluene	3	1.0	-
1,2,3,5 Tetrachlorobenzene	3	1.0	100
1,2,4,5 Tetrachlorobenzene	3	1.0	150
2,6a Trichlorotoluene	3	1.0	-
1,2,3,4 Tetrachlorobenzene	3	1.0	100
Pentachlorobenzene	3	1.0	30
Chlorinated Phenols (ng/l)			
2,4,5 Trichlorophenol	3	50.0	18000
2,3,4 Trichlorophenol	3	100.0	18000
2,3,5,6 Tetrachlorophenol	3	50.0	1000
2,3,4,5 Tetrachlorophenol	3	50.0	1000

TABLE 4.10: OGILVIE MILLS 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Phenoxy Acids (ng/l)			
Dicamba	3	100.0	200000
2,4,D Propionic Acid	3	100.0	-
2,4 Dichlorophenoxyacetic	3	100.0	4000
Silvex	3	50.0	3000[3]
2,4,5 Trichlorophenoxyacetic	3	50.0	-
2,4 Dichlorophenoxybutyrc	3	200.0	-
Picloram	3	100.0	-
Fatty Acids (ug/l)			
Capric	3	10.0	-
Aromatic Acids (ug/l)			
Benzoic	3	10.0	-
Salicylic	3	10.0	-
Phthalic	3	10.0	-
Resin Acids (ug/l)			
Palustric/Levopimaric	3	10.0	-
Neoabietic	3	10.0	-
Abietic	3	10.0	-
Volatiles (ug/l)			
1,1 Dichloroethylene	6	1.0-20.0	3[3]
1,2 Dichloroethylene	6	1.0-20.0	-
1,1 Dichloroethane	6	1.0-20.0	-
1,1,1 Trichloroethane	6	1.0-20.0	120[3]
1,2 Dichloroethane	6	1.0-20.0	560[3]
Carbontetrachloride	6	1.0-20.0	27[3]
Benzene	6	1.0-20.0	300[2]
Trichloroethylene	6	1.0-20.0	94[3]
Dichlorobromomethane	6	1.0-20.0	-
Toluene	6	1.0-20.0	300[2]
1,1,2 Trichloroethane	6	1.0-20.0	-
Chlorodibromomethane	6	1.0-20.0	350*
Tetrachloroethylene	6	1.0-20.0	260[2]
Chlorobenzene	6	1.0-20.0	71[3]
Trifluorochlorotoluene	4	1.0-20.0	-

TABLE 4.10: OGILVIE MILLS 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Volatiles (ug/l) (Continued)			
Ethylbenzene	6	1.0-20.0	700[2]
Ethylene Dibromide	4	1.0-20.0	-
M & P Xylenes	6	1.0-20.0	40[3]
Bromoform	6	1.0-20.0	1500[4]
O-xylene	6	1.0-20.0	-
1,1,2,2 Tetrachloroethane	6	1.0-20.0	-
1,4 Dichlorobenzene	6	1.0-20.0	4
1,3 Dichlorobenzene	6	1.0-20.0	2.5
1,2 Dichlorobenzene	6	1.0-20.0	2.5
PAH (ng/l)			
Phenanthrene	2	0.0	-
Anthracene	2	0.0	-
Fluoranthene	2	0.0	-
Pyrene	2	0.0	-
Benz (A) Anthracene	2	0.0	-
Chrysene	2	0.0	-
Dimeth. Benz (A) Anthracene	2	0.0	-
Benzo (E) Pyrene	2	0.0	-
Benzo (J) Fluoranthene	2	0.0	-
Benzo (B) Fluoranthene	2	0.0	-
Perylene	2	0.0	-
Benzo (K) Fluoranthene	2	0.0	-
Benzo (A) Pyrene	2	0.0	10[2]*
Benzo (G,H,I) Perylene	2	0.0	-
Dibenz (A,H) Anthracene	2	0.0	-
Indeno (1,2,3 - C,D) Pyrene	2	0.0	-
Benzo (B) Chrysene	2	0.0	-
Metals (mg/l)			
Aluminum	3	1.0	0.10[2]
Beryllium	3	0.05	0.011
Cadmium	3	0.01	0.0002
Cobalt	3	0.10	-
Chromium	3	0.10	0.10
Nickel	3	0.10	0.025
Lead	3	0.10	0.020
Vanadium	3	0.10	-

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
[4] Ontario Advisory
- No Criteria
* Drinking Water Objective

TABLE 4.11: OGILVIE MILLS 1986 EFFLUENT SAMPLING RESULTS - DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)					
Heptachlor	3	2	12-42	1.0	1.0
pp-DDE	3	1	120	1.0	3.0
ɣ-Chlordane	3	1	29	2.0	60.0
pp-DDD	3	1	25	5.0	3.0
Endosulfan II	3	1	58	4.0	3.0
Dieldrin	3	2	4-46	4.0	1.0
Endrin	3	1	22	2.0	2.0
Chlorinated Phenols (ng/l)					
2,4,6 Trichlorophenol	3	1	320	50.0	18000
Pentachlorophenol	3	1	80	50.0	500
Fatty Acids (ug/l)					
Lauric	3	2	32-250	10.0	-
Myristic	3	2	189-460	10.0	-
Palmitic	3	2	2548-2880	10.0	-
Stearic	3	2	150-340	10.0	-
Oleic/Linoleic	3	1	904	10.0	-
Arachidic	3	2	18-40	10.0	-
Resin Acids (ug/l)					
Pimaric	3	1	392	10.0	-
Sandaracopimaric	3	1	370	10.0	-
Isopimaric	3	2	45-898	10.0	-
Dehydroabietic	3	1	28	10.0	8.0[5]
Volatiles (ug/l)					
Dichloromethane	6	4	60-81	1.0-20.0	5,000[4]
Chloroform	6	1	175	1.0-20.0	1,200[4]
Metals (mg/l)					
Iron	3	3	1.50-4.10		0.30
Manganese	3	3	0.33-0.71	0.10	0.05*
Copper	3	2	0.15-0.34	0.10	0.005
Mercury** (ug/l)	3	3	0.03-0.11		0.20**
Strontium	3	3	0.08	0.05	-
Zinc	3	3	0.36-1.10	0.10	0.030

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
[4] Ontario Advisory
[5] Provincial Water Quality Guideline for pH = 7
\- No Criteria
* Drinking Water Objective
** Sample results are unfiltered, criteria applicable to filtered results.

examined further in the next chapter of the report in light of receiving water impacts.

It should be noted that the treatment system utilized by Ogilvie Mills suffered an upset on August 13 from approximately 2:45 a.m. to 10:40 p.m. This time period was covered almost equally by the second and third composite samples. For most of the detected parameter concentrations, higher levels occurred for these two composites with the exception of the Fatty Acids group.

4.4 Thunder Bay Sewage Treatment Plant

Effluent from the Thunder Bay Sewage Treatment Plant (STP) is discharged to the Kaministiquia River via a submerged outfall. As with Ogilvie Mills, only three 24-hour composite samples were collected at the STP. The list of sample parameters was the same as that for CPFP.

Sampling results are summarized in Tables 4.12 and 4.13. Parameters that were not detected in the STP effluent are listed in Table 4.12. Of these 95 parameters, 51 parameters had no applicable criteria or a detection limit that was greater than the criteria. These parameters should be given a lower priority for developmental work. Forty-four parameters remain for which the detection level is lower than the criteria level. No further analysis of these parameters is required.

As described in the previous section, with only three sample results, there is no need to further screen the dataset into frequently and infrequently detected parameters. Table 4.13 lists the remaining parameters, 27 in total, that were detected in the STP effluent.

No applicable screening criteria are available for 11 of the parameters. These parameters should be given a higher priority for developmental work. Detected levels of nine of the parameters were below criteria values and require no further analysis. The remaining seven parameters will be examined further in the next chapter of the report in light of receiving water impacts.

TABLE 4.12: THUNDER BAY STP 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS

Parameter	No. of Samples	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)			
PCB	3	20.0	1.0
Hexachlorobenzene	3	1.0	6.5
Heptachlor	3	1.0	1.0
Aldrin	3	1.0	1.0
pp-DDE	3	1.0	3.0
Mirex	3	5.0	1.0
α-BHC	3	1.0	10.0
β-BHC	3	1.0	10.0
α-chlordane	3	2.0	60.0
ɣ-chlordane	3	2.0	60.0
Oxychlordane	3	2.0	-
pp-DDD	3	5.0	3.0
pp-DDT	3	5.0	3.0
DMDT Methoxychlor	3	5.0	40.0
Heptachlorepoxide	3	1.0	1.0
Endosulfan I	3	2.0	3.0
Endosulfan II	3	4.0	3.0
Dieldrin	3	2.0	1.0
Endrin	3	4.0	2.0
Endosulfan Sulphate	3	4.0	3.0
Octachlorostyrene	3	4.0	-
Chlorobenzenes (ng/l)			
Hexachloroethane	3	1.0	13000[3]
1,3,5 Trichlorobenzene	3	2.0	650
1,2,4 Trichlorobenzene	3	2.0	500
Hexachlorobutadiene	3	1.0	100[2]
1,2,3 Trichlorobenzene	3	2.0	900
2,4,5 Trichlorotoluene	3	1.0	-
2,3,6 Trichlorotoluene	3	1.0	-
1,2,3,5 Tetrachlorobenzene	3	1.0	100
1,2,4,5 Tetrachlorobenzene	3	1.0	150
2,6a Trichlorotoluene	3	1.0	-
1,2,3,4 Tetrachlorobenzene	3	1.0	100
Pentachlorobenzene	3	1.0	30
Chlorinated Phenols (ng/l)			
2,4,5 Trichlorophenol	3	50.0	18000
2,3,4 Trichlorophenol	3	100.0	18000
2,3,5,6 Tetrachlorophenol	3	50.0	1000
2,3,4,5 Tetrachlorophenol	3	50.0	1000

TABLE 4.12: THUNDER BAY STP 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Phenoxy Acids (ng/l)			
Dicamba	3	100.0	200000
2,4,D Propionic Acid	3	100.0	-
2,4 Dichlorophenoxyacetic	3	100.0	4000
Silvex	3	50.0	3000[3]
2,4,5 Trichlorophenoxyacetic	3	50.0	-
2,4 Dichlorophenoxybutyrc	3	200.0	-
Picloram	3	100.0	-
Fatty Acids (ug/l)			
Capric	3	10.0	-
Lauric	3	10.0	-
Aromatic Acids (ug/l)			
Benzoic	3	10.0	-
Salicylic	3	10.0	-
Phthalic	3	10.0	-
Resin Acids (ug/l)			
Sandaracopimaric	3	10.0	-
Palustric/Levopimaric	3	10.0	-
Isopimaric	3	10.0	-
Neoabietic	3	10.0	-
Abietic	3	10.0	-
Dehydroabietic	3	10.0	8.0[5]
Volatiles (ug/l)			
1,1 Dichloroethylene	5	1.0-10.0	3[3]
1,2 Dichloroethylene	5	1.0-10.0	-
1,1 Dichloroethane	5	1.0-10.0	-
Chloroform	5	1.0-10.0	1200[4]
1,1,1 Trichloroethane	5	1.0-10.0	120[3]
1,2 Dichloroethane	5	1.0-10.0	560[3]
Carbontetrachloride	5	1.0-10.0	27[3]
Benzene	5	1.0-10.0	300[2]
Trichloroethylene	5	1.0-10.0	94[3]
Dichlorobromomethane	5	1.0-10.0	-
1,1,2 Trichloroethane	5	1.0-10.0	-
Chlorodibromomethane	5	1.0-10.0	350*

TABLE 4.12: THUNDER BAY STP 1986 EFFLUENT SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Volatiles (ug/l) (Continued)			
Chlorobenzene	5	1.0-10.0	71[3]
Trifluorochlorotoluene	5	1.0-10.0	-
Ethylbenzene	5	1.0-10.0	700[2]
Ethylene Dibromide	5	1.0-10.0	-
M & P Xylenes	5	1.0-10.0	40[3]
Bromoform	5	1.0-10.0	1500[4]
O-xylene	5	1.0-10.0	-
1,1,2,2 Tetrachloroethane	5	1.0-10.0	-
1,4 Dichlorobenzene	5	1.0-10.0	4
1,3 Dichlorobenzene	5	1.0-10.0	2.5
1,2 Dichlorobenzene	5	1.0-10.0	2.5
PAH (ng/l)			
Phenanthrene	2	0.0	-
Anthracene	2	0.0	-
Benz (A) Anthracene	2	0.0	-
Chrysene	2	0.0	-
Dimeth. Benz (A) Anthracene	2	0.0	-
Benzo (E) Pyrene	2	0.0	-
Benzo (J) Fluoranthene	2	0.0	-
Perylene	2	0.0	-
Benzo (G,H,I) Perylene	2	0.0	-
Dibenz (A,H) Anthracene	2	0.0	-
Indeno (1,2,3-C,D) Pyrene	2	0.0	-
Benzo (B) Chrysene	2	0.0	-
Metals (mg/l)			
Beryllium	3	0.01 -0.5	0.011
Cadmium	3	0.001-0.01	0.0002
Cobalt	3	0.01 -0.10	-
Nickel	3	0.01 -0.10	0.025
Vanadium	3	0.01 -0.10	-

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
[4] Ontario Advisory
[5] Provincial Water Quality Guideline for pH = 7
- No Criteria
* Drinking Water Objective

TABLE 4.13: THUNDER BAY STP 1986 EFFLUENT SAMPLING RESULTS - DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Level	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)					
γ-BHC	3	1	250	1.0	10.0
op-DDT	3	1	10	5.0	3.0
Chlorinated Phenols (ng/l)					
2,4,6 Trichlorophenol	3	2	130-340	50.0	18000
Pentachlorophenol	3	3	130-410	50.0	500
Fatty Acids (ug/l)					
Myristic	3	2	13-25	10.0	-
Palmitic	3	2	84-141	10.0	-
Stearic	3	1	144	10.0	-
Oleic/Linoleic	3	2	112-270	10.0	-
Arachidic	3	1	14	10.0	-
Resin Acids (ug/l)					
Pimaric	3	1	75	10.0	-
Volatiles (ug/l)					
Dichloromethane	5	4	20-63	1.0-10.0	5000[4]
Toluene	5	1	16	1.0-10.0	300[2]
Tetrachloroethylene	5	1	10	1.0-10.0	260[2]
PAH (ng/l)					
Fluoranthene	4	1	4-20	0.0	-
Pyrene	4	1	20-100	0.0	-
Benzo (B) Fluoranthene	4	1	4-20	0.0	-
Benzo (K) Fluoranthene	2	1	2-10	0.0	-
Benzo (A) Pyrene	2	1	4-20	0.0	10[3]*

TABLE 4.13: THUNDER BAY STP 1986 EFFLUENT SAMPLING RESULTS - DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	No. of Detections	Detected Level	Detection Limit	Criteria[1]
Metals (mg/l)					
Iron	3	3	7.1 -9.6		0.30
Manganese	3	3	0.32-0.35	0.01-0.10	0.05*
Aluminum	3	1	0.16	0.10-1.0	0.10[2]
Chromium	3	2	0.01-0.02	0.01-0.10	0.10
Copper	3	2	0.03-0.03	0.01-0.10	0.005
Mercury** (ug/l)	2	2	0.05-0.11		0.20**
Lead	3	2	0.01-0.01	0.01-0.10	0.020
Strontium	3	3	0.08-0.08	0.01-0.05	-
Zinc	3	2	0.03-0.03	0.01-0.10	0.030

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
[4] Ontario Advisory
- No Criteria
* Drinking Water Objective
** Sample results are unfiltered, criteria applicable to filtered results.

5.0 RECEIVING WATER QUALITY

Section 3.0 described in detail the receiving water surveys carried out as part of the MISA Pilot Site Study. The receiving water surveys were conducted to provide, 1) a direct measure of the state of the Lower Kaministiquia River in relation to applicable criteria, and 2) input data for any modelling work required to set effluent limits. As with the effluent monitoring program, a greater emphasis was placed on monitoring the receiving water in the vicinity of the Canadian Pacific Forest Products (CPFP).

Several other programs have collected and continue to collect receiving water quality data in addition to the MISA Pilot Site sampling program. These include the ongoing Provincial Water Quality Monitoring Network Program and regional surveys. Only data collected as part of the pilot site was included in this report.

Within the Kaministiquia River watershed, the Water Survey of Canada operates several continuous streamflow recording stations (See Figure 2.1). The first streamflow station upstream of the study area is located at the Kakabeka Falls powerhouse. Concerns over water quality degradation in the lower river, identified in an earlier study (MOE, 1972), lead to an agreement between MOE and Ontario Hydro, whereby Hydro would attempt to maintain a minimum flow of 17 m^3/s at the Kakabeka Falls powerhouse station. This station has been in operation since 1923, however, daily streamflow discharges have only been published since 1975. Data from the next upstream station, at the city of Kaministiquia, was used to perform a low flow frequency analysis.

The average recurrence intervals for streamflow in the Kaministiquia River at Kaministiquia utilizing data from 1971 to 1985 are shown in Figure 5.1. Records prior to 1971 were not used as the agreement with Hydro was initiated in 1971. Utilizing the 7Q20 (7 day low flow with an average recurrence interval of 20 years) criterion for determining the design flow, yields 15.5 m^3/s. While these two figures, the 7Q20 and the Hydro minimum,

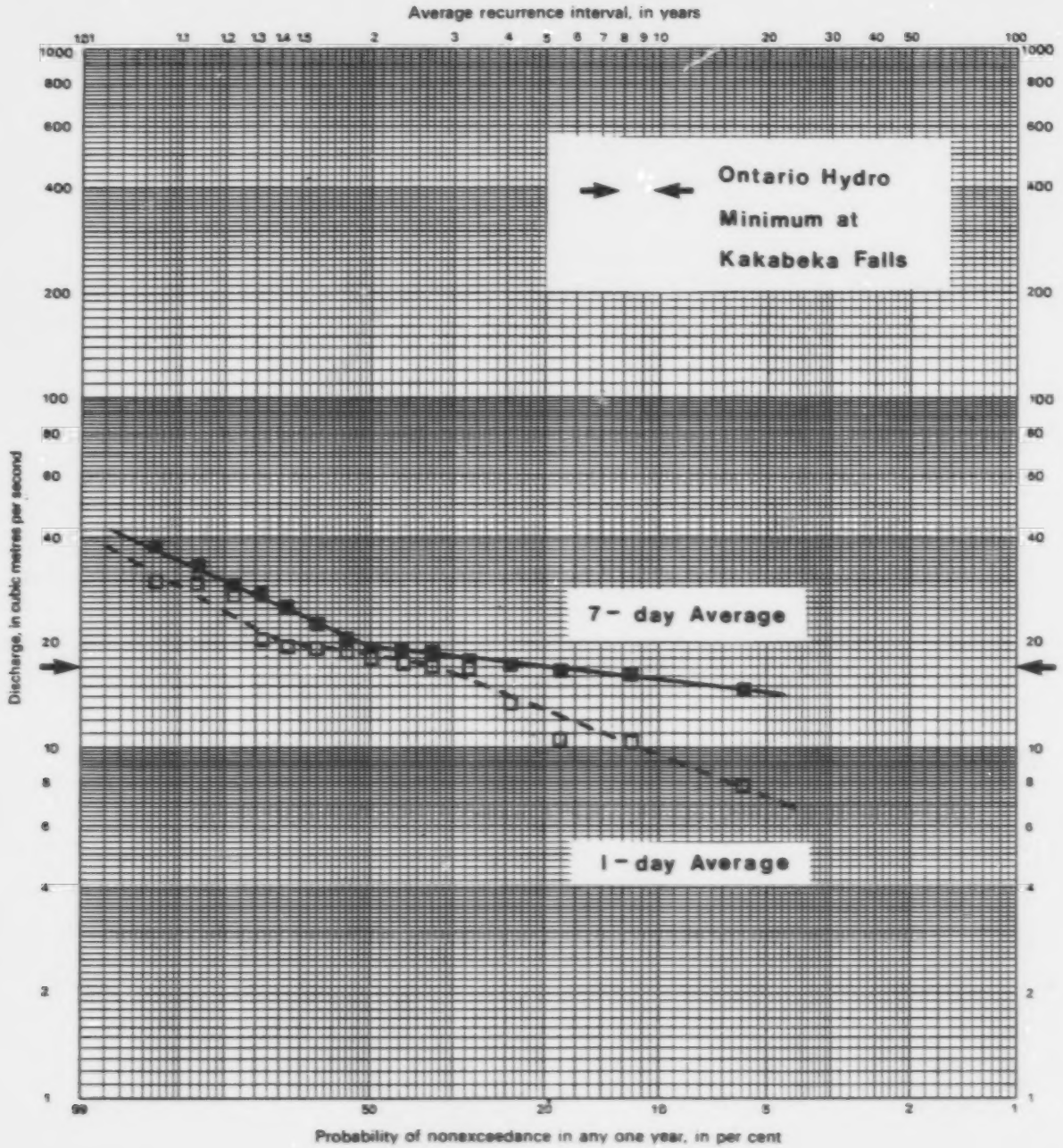


FIGURE 5:1 : Average Recurrence Internal -
Kaministiquia River at Kaministiquia

are not equal, it is felt that the Hydro minimum of 17 m^3/S reflects the design flow for such a highly regulated system.

During the two survey periods, July 28 to August 1, 1986 and August 11 to August 15, 1986, Ontario Hydro was asked to regulate the system outside of normal operating procedures such that the minimum flow of 17 m^3/s would occur at Kakabeka Falls. Table 5.1 lists the observed flows for July and August 1986. It is evident that a reasonable level of agreement with the Hydro minimum was achieved.

In order to quantify the amount of flow input to the river between Kakabeka Falls and the study area, streamflow was metered at the city of Stanley. This location represents the first access point upstream of the backwater effects of Lake Superior. Two flow measurements were taken and showed an increase of 0.6 to 2.3 m^3/s (Klose, 1988). For the purposes of further analysis and modelling, 20 m^3/s was used as the design flow entering the study area.

Attempts to meter streamflow within the study area were generally unsuccessful. Back water effects as well as the intrusion of lake-water made the interpretation of results difficult. Portions of the data were extremely useful however, as measurements of velocity were used to determine the time-of-travel between river stations (Klose, 1988).

Receiving water quality results will be presented first for all monitored stations followed by a more detailed examination of station to station differences. Up to 131 parameters were measured at each station. A complete listing of sample results is presented in Appendix C. As in the previous chapter, a hierarchal screening approach was used to reduce the number of parameters to those of significance. The first level of screening was based on a detection or non-detection. Non-detected parameters can generally be excluded from further analysis. The exception being for cases where the detection limit is greater than a specified objective. In these instances the parameter was identified as requiring developmental work in lowering the detection limit.

TABLE 5.1:

KAMINISTIQUIA RIVER STREAMFLOW AT KAKABEKA FALLS POWER HOUSE

DAILY DISCHARGE IN CUBIC METRES PER SECOND		
DAY	JULY	AUGUST
1	83.1	42.1
2	95.8	47.3
3	94.5	47.2
4	105	45.7
5	114	43.5
6	110	43.9
7	111	44.7
8	109	42.3
9	88.3	44.6
10	76.5	41.2
11	66.3	19.7
12	72.0	18.1
13	69.8	18.1
14	70.0	17.6
15	69.8	19.1
16	69.1	27.4
17	56.9	27.4
18	60.2	26.2
19	72.9	34.3
20	69.6	34.4
21	69.2	35.8
22	69.2	30.4
23	65.1	31.3
24	86.1	29.6
25	78.7	29.3
26	69.1	30.8
27	68.3	29.3
28	52.0	28.3
29	21.6	28.9
30	18.0	31.3
31	22.0	29.9
TOTAL	2283.1	1019.7
MEAN	73.6	32.9
MAX	114	47.3
MIN	18.0	17.6

Summary for the year 1986

Mean discharge, 59.6 m^3/s
Total discharge, 1880000 dam^3
Maximum daily discharge, 229 m^3/s on April 30
Minimum daily discharge, 17.6 m^3/s on August 14

Receiving water objectives were drawn primarily from the Provincial Water Quality Objectives (PWQO) (MOE, 1984). Those parameters for which there are no PWQOs were assigned objectives from other sources (CCREM, 1987, Michigan, 1984).

The next level of screening was based on an arbitrary level of detection. Parameters that were detected less than 25% of the time at any one station were classed as infrequently detected parameters. Parameters detected above this level were classed as frequently detected parameters and were examined in more detail.

As with the effluent monitoring data, a detailed statistical analysis of the receiving water monitoring data was limited due to the limited number of samples collected. Temporal changes in receiving water quality throughout the year could not be assessed as samples were collected within a one week period.

Variations in the detection frequency between effluent and receiving water samples may be affected by mixing of the effluent with the receiving water, changes in detection levels, and the spatial distribution of the surface water sampling stations. Effluent and receiving water mixing has the effect of reducing effluent concentrations, which may be reduced below detection levels, with the result that certain parameters may not be detected in stream.

5.1 Screening Results

The screening results for all samples at all stations are presented in Tables 5.2 to 5.4. Parameters that were not detected in any sample, which total 71, are listed in Table 5.2. Those parameters that have no criteria or for which the detection limit is greater than the criteria, 35 parameters, should be given a low priority for developmental work. The 36 remaining parameters, for which the detection limit is less than the criteria, require no further analysis.

TABLE 5.2: KAMINISTIQUIA RIVER 1986 SAMPLING RESULTS - NON-DETECTED PARAMETERS

Parameter	No. of Samples	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)			
PCB	19	20.0	1.0
Heptachlor	19	1.0	1.0
pp-DDE	19	1.0	3.0
Mirex	19	5.0	1.0
β-BHC	19	1.0	10.0
op-DDT	19	5.0	3.0
pp-DDD	19	5.0	3.0
pp-DDT	19	5.0	3.0
DMDT Methoxychlor	19	5.0	40.0
Heptachlorepoxide	19	1.0	1.0
Endosulfan II	19	4.0	3.0
Dieldrin	19	2.0	1.0
Endrin	19	4.0	2.0
Endosulfan Sulphate	19	4.0	3.0
Octachlorostyrene	19	1.0	-
Chlorobenzenes (ng/l)			
Hexachloroethane	19	1.0	13000[3]
1,3,5 Trichlorobenzene	19	5.0	650
1,2,4 Trichlorobenzene	19	5.0	500
Hexachlorobutadiene	19	1.0	100[2]
1,2,3 Trichlorobenzene	19	5.0	900
2,4,5 Trichlorotoluene	19	5.0	-
2,3,6 Trichlorotoluene	19	5.0	-
1,2,3,5 Tetrachlorobenzene	19	1.0	100
1,2,4,5 Tetrachlorobenzene	19	1.0	150
2,6a Trichlorotoluene	19	5.0	-
1,2,3,4 Tetrachlorobenzene	19	1.0	100
Pentachlorobenzene	19	1.0	30
Chlorinated Phenols (ng/l)			
2,3,4 Trichlorophenol	27	100.0	18000
2,3,4,5 Tetrachlorophenol	27	50.0	1000

TABLE 5.2: KAMINISTIQUIA RIVER 1986 SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Phenoxy Acids (ng/l)			
Dicamba	7	100.0	200000
2,4 Dichlorophenoxyacetic	7	100.0	4000
Silvex	7	50.0	3000[3]
2,4,5 Trichlorophenoxyacetic	7	50.0	-
2,4 Dichlorophenoxybutyrc	7	200.0	-
Fatty Acids (ug/l)			
Capric	83	10.0	-
Lauric	83	10.0	-
Myristic	83	10.0	-
Arachidic	83	10.0	-
Aromatic Acids (ug/l)			
Salicylic	83	10.0	-
Phthalic	83	10.0	-
Resin Acids (ug/l)			
Palustric/Levopimaric	83	10.0	-
Speciated Phenolics (ug/l)			
Phenol	45	1.0	1.0
Homoanillic Acid	45	1.0	-
Guaicol	45	1.0	-
Syringaldehyde	45	1.0	-
Aceto Vanillone	45	1.0	-
Acetosyringone	45	1.0	-
Volatiles (ug/l)			
1,1 Dichloroethylene	84	0.0	3[3]
Dichloromethane	84	0.0	5000[4]
1,2 Dichloroethylene	84	0.0	-
1,1 Dichloroethane	84	0.0	-
1,1,1 Trichloroethane	84	0.0	120[3]
1,2 Dichloroethane	84	0.0	560[3]
Carbontetrachloride	84	0.0	27[3]
Benzene	84	0.0	300[2]
Trichloroethylene	84	0.0	94[3]
Dichlorobromomethane	84	0.0	-
1,1,2 Trichloroethane	84	0.0	-
Chlorodibromomethane	84	0.0	350*

TABLE 5.2: KAMINISTIQUIA RIVER 1986 SAMPLING RESULTS - NON-DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	Detection Limit	Criteria[1]
Volatiles (ug/l) (Continued)			
Tetrachloroethylene	84	0.0	260[2]
Chlorobenzene	84	0.0	71[3]
Trifluorochlorotoluene	84	0.0	-
Ethylbenzene	84	0.0	700[2]
Ethylene Dibromide	84	0.0	-
Bromoform	84	0.0	1500[4]
1,1,2,2 Tetrachloroethane	84	0.0	-
1,4 Dichlorobenzene	84	0.0	4
1,3 Dichlorobenzene	84	0.0	2.5
1,2 Dichlorobenzene	84	0.0	2.5
Metals (mg/l)			
Beryllium	75	0.001	0.011
Cobalt	75	0.001	-

1 All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
2 CCREM
3 Michigan
4 Ontario Advisory
- No Criteria
* Drinking Water Objective

TABLE 5.3: KAMINISTIQUIA RIVER 1986 SAMPLING RESULTS - INFREQUENTLY DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
PCB/Organochlorine (ng/l)					
Hexachlorobenzene	19	1	2	1.0	6.5
Aldrin	19	1	2	1.0	1.0
α-BHC	19	16	1-4	1.0	10.0
ɣ-BHC	19	1	1	1.0	10.0
α-Chlordane	19	2	5-10	2.0	60.0
ɣ-Chlordane	19	1	5	2.0	60.0
Oxychlordane	19	1	7	2.0	-
Endosulfan I	19	1	3	2.0	3.0
Chlorinated Phenols (ng/l)					
2,4,5 Trichlorophenol	27	1	70	50.0	18,000
2,3,5,6 Tetrachlorophenol	27	5	50-70	50.0	1,000
Pentachlorophenol	25	4	50-90	50.0	500
Phenoxy Acids (ng/l)					
2,4,D Propionic Acid	8	1	380	100.0	-
Fatty Acids (ug/l)					
Palmitic	83	2	11-13	10.0	-
Stearic	83	2	18-21	10.0	-
Oleic/Linoleic	83	9	11-17	10.0	-
Aromatic Acids (ug/l)					
Benzoic	83	1	97	10.0	-
Resin Acids (ug/l)					
Pimaric	83	5	11-14	10.0	-
Sandaracopimaric	83	5	8-17	10.0	-
Neoabietic	83	2	18-32	10.0	-
Speciated Phenolics (ug/l)					
Vanillin	45	3	1-1	1.0	-

TABLE 5.3: KAMINISTIQUIA RIVER 1986 SAMPLING RESULTS - INFREQUENTLY DETECTED PARAMETERS (Continued)

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
Volatiles (ug/l)					
Toluene	84	2	1- 1	0.0	300[2]
M & P Xylenes	84	4	1- 3	0.0	40[3]
O-xylene	84	1	3	0.0	-
Metals (mg/l)					
Cadmium	75	9	0.003-0.0010	0.0003	0.0002
Mercury**(ug/l)	82	14	0.01-0.02	0.01	0.2**
Nickel	75	14	0.002-0.004	0.002	0.025
Lead	75	7	0.004-0.032	0.003	0.020

[1] All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
[2] CCREM
[3] Michigan
- No Criteria
** Sample results are unfiltered, criteria applicable to filtered results

TABLE 5.4: KAMINISTIQUIA RIVER 1986 SAMPLING RESULTS - FREQUENTLY DETECTED PARAMETERS

Parameter	No. of Samples	No. of Detections	Detected Concentration	Detection Limit	Criteria[1]
Chlorinated Phenols (ng/l)					
2,4,6 Trichlorophenol	27	16	80-1200	50.0	18,000
Resin Acids (ug/l)					
Isopimaric	83	13	12- 40	10.0	-
Abietic	83	24	9- 250	10.0	-
Dehydroabietic	83	44	11- 88	10.0	8.0[5]
Volatiles (ug/l)					
Chloroform	84	76	37- 244	0.0	1,200[4]
Metals (mg/l)					
Iron	75	75	0.27-0.85		0.30
Manganese	75	75	0.014-0.110	0.001	0.05*
Aluminum	75	75	0.10-0.59	0.010	0.10[2]
Chromium	75	70	0.001-0.041	0.001	0.10
Copper	75	75	0.001-0.004	0.001	0.005
Strontium	75	75	0.024-0.040	0.001	-
Vanadium	75	71	0.001-0.002	0.001	-
Zinc	75	73	0.001-0.060	0.001	0.030

1 All criteria listed are Ontario Provincial Water Quality Objectives except where noted.
2 CCREM
3 Michigan
4 Ontario Advisory
5 Provincial Water Quality Guideline for pH = 7.
- No Criteria
* Drinking Water Objective

As described in Section 5.0 the next level of screening is based on the frequency of detection. Parameters that were detected infrequently (ie: less than 25% of the time) are listed in Table 5.3. It should be noted that α - BHC was included in Table 5.3 as all 16 detections had the accompanying remark code <T (see Table 3.1), thus the presence of this parameter could not be confirmed. Thirteen parameters were detected below criteria levels and require no further analysis. No criteria are available for 11 of the parameters. These parameters should be given a lower priority for developmental work. Three parameters remain which were detected above criteria levels, Aldrin, Cadmium and Lead.

Aldrin had only a single detection at trace levels at Station A, and thus requires no further analysis. It is difficult to interpret the cadmium results as the current detection level is greater than the criterion. Also, cadmium only had a single detection in all of the effluent sampling. No further analysis of cadmium is required, also it need not be included in further sampling programs until lower detection limits are available. Three of the seven lead detections were above criterion levels. Effluent sampling results were inconclusive as to identifying a possible source. No further analysis of lead is required.

Thirteen frequently detected parameters are listed in Table 5.4. No criteria are available for four of the parameters. Criteria development work should be given higher priority for these parameters. The remaining parameters will be examined further in the next section.

Comparing the frequency of parameter detection between the receiving water and effluent sampling shows several apparent anomalies. Comparing Table 5.2, undetected parameters for receiving water samples, with effluent sampling results for frequently and infrequently detected parameters shows several parameters within the following sub-groups which were detected in one of the effluent discharges but not in the receiving water:

PCB/Organocholorine	(e.g.: Heptachlor, Dieldrin)
Chlorinated Phenols	(e.g.: 2,3,4,5 Tetrachlorophenol)
Phenoxy Acids	(e.g.: 2,4 Dichlorophenoxy acetic)
Resin, Fatty & Aromatic Acids	(e.g.: Capric, Salicylic)
Speciated Phenolics	(e.g.: Phenol, Guaicol)
Volatiles	(e.g.: 1,4 Dichlorobenzene)

Examination of the effluent monitoring results for these parameters shows that generally they occur at levels marginally above detection limits, thus when mixed with the receiving stream, concentrations drop below the detection level. It should be noted that the same detection level exists for these sub-groups, with the exception of the Volatiles, for both the effluent and receiving water samples.

Several parameters within the PCB/Organochlorine sub-group (e.g., Aldrin, α-BHC) were not detected within any of the effluent discharges but were detected in the receiving water. Given the nature of these parameters it is likely that they originated from other sources than those monitored, either upstream of the study area, diffuse urban sources from within the city, or from Thunder Bay harbour. Alternatively, given the fact that all of the detections of these parameters were at "trace" levels, the detections may only be an artifact of the laboratory technique. Further sampling would be required to confirm the instream detections and identify a possible source.

5.2 Spatial and Temporal Trends

Sample results presented in the previous section were lumped together across all stream sampling stations. In this section those parameters listed in Table 5.4 will be examined further looking at the spatial and temporal trends.

Sample results for these parameters are presented in Figure 5.2. A Box and

FIGURE 5.2: Receiving Water Quality

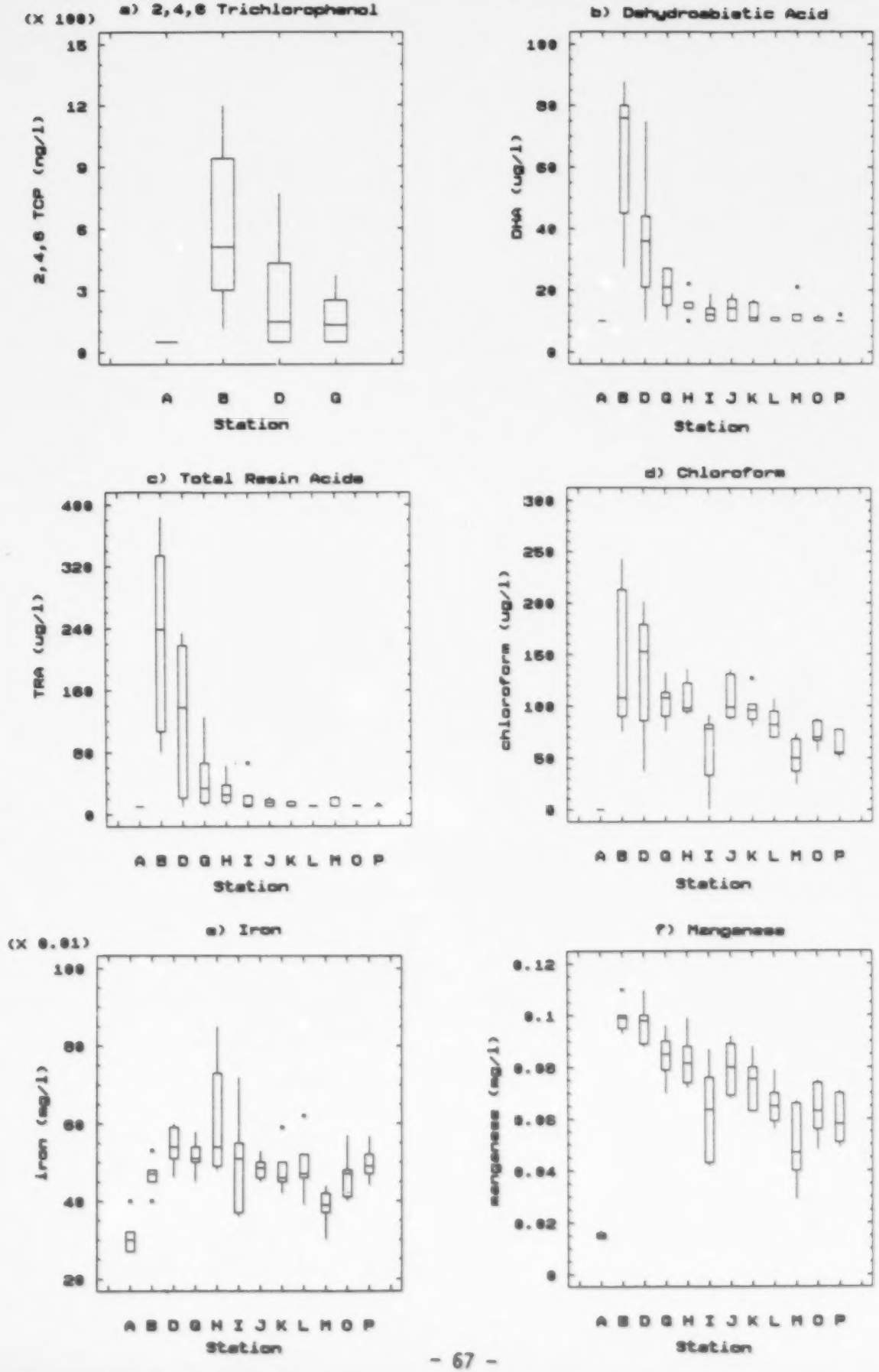
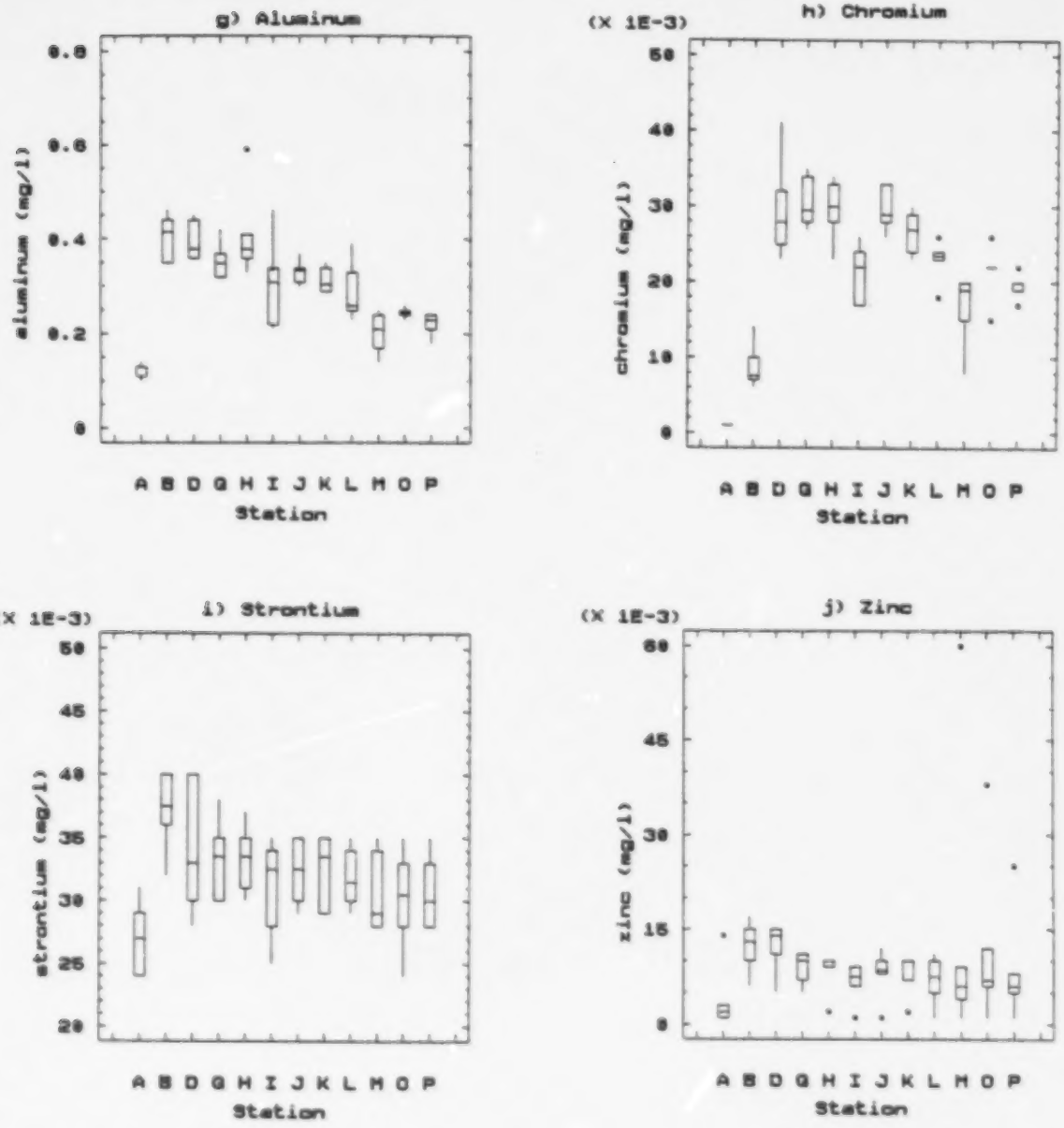


FIGURE 5.2: Receiving Water Quality (Continued)



Whisker plotting technique has been utilized to summarize the data. For a complete description of the technique, see Chambers, et al., 1983.

Several parameters listed in Table 5.2 have not been included in Figure 5.2 for various reasons. Within the resin acids group, isopimaric and abietic acids were not plotted due to the lack of applicable criteria. Additionally, all the resin acids have been included in the plot of the total resin acids parameter which is an arithmetic total of the detected concentrations of the individual resin acids. Vanadium was also not included due to the lack of a criterion and the level of detected concentrations. Only 4 of the 71 detections were at the 0.002 mg/l level with the remainder at 0.001 mg/l. No spatial or temporal trends could be identified. Copper was also excluded for this reason.

2,4,6 Trichlorophenol

As described in section 3.0, the chlorophenols group was only sampled instream up to station G. The results show that even though there is a significant elevation in 2,4,6 Trichlorophenol (TCP) below the CPFP outfall, concentrations remained below the criterion level.

DeHydroabietic Acid (DHA)

Instream DHA concentrations showed a significant response to the discharge from CPFP. Concentrations were also elevated above the criterion level at the point of discharge and remained above the criterion throughout the study area. It should be noted however that the criterion is below the current detection limit and therefore it is difficult to determine if concentrations would have dropped below the criterion at the downstream end of the study area.

Total Resin Acids (TRA)

As with DHA, TRA showed a significant response to the CPFP discharge. This is not supprising as DHA was one of the major components in the

determination of TRA. The criterion level was exceeded at the point of discharge and further downstream to Stations G and H.

Chloroform

Chloroform concentrations were also elevated below the CPFP outfall. Peak concentrations however, remained below the criterion level. It is interesting to note that while peak concentrations dropped from Station B to D, the median concentration increased. Reichhold chemical was the only point source discharge between station B and D and had chloroform detected only infrequently (1 detection in 10 samples). The rise in median concentration may have been due to incomplete mixing of effluent chloroform with the receiving water.

Iron

The median concentration level at the upstream station equalled the criterion level. Any additional iron discharged above the criterion level will have the effect of raising iron concentrations above the criterion as is shown in the graph. The median concentration increased from station B to D with only input from Reichhold chemical. The effluent levels of iron from Reichhold chemical however, were at low levels, thus the rise may have been due to incomplete mixing at station B. The rise in iron levels from station K to station O and P was likely due to the sewage treatment plant discharge. With a river bottom discharge between station O and P, mixing characteristics as well as movement upstream with the Lake water may account for the increase in concentration at station O.

Aluminum

All measured instream aluminum concentrations were above the criterion level, including measurements at the upstream station. The major influence on Aluminum concentrations again was due to the CPFP discharge.

Manganese

Manganese concentrations were elevated below the CPFP discharge above the criterion level. It should be noted however that the criterion is a drinking water criterion and is not directly applicable to receiving water concentrations. For this reason effluent reductions were not calculated for manganese.

Chromium

Chromium concentrations remained below the criterion throughout the study area. Background concentrations were all measured at the detection limit and have been elevated by the CPFP discharge further downstream. It is interesting to note that peak instream concentrations were measured at Station D and not Station B. This is likely due to the proximity of the B outfall of CPFP, from which the major chromium load is discharged, to Station B such that complete mixing of the effluent and receiving water occurred further downstream.

Strontium

No criterion was available for strontium, however it appears that there was an effect due to the CPFP discharge.

Zinc

Zinc concentrations also remained below the criterion level throughout the study area, with the exception of two measurements, once each at station M and O. Detected levels in the Sewage Treatment Plant discharge were below criterion levels. The source of zinc may be from the Harbour or unidentified inputs. It is evident that the CPFP discharge raised instream zinc concentrations.

5.3 Discussion

The sampling results presented in the previous sections show that the lower

Kaministiquia River is dominated by the discharge from CPFP. A comparison of Tables 4.4 and 5.4, which list the frequently detected parameters for both the CPFP effluent and the receiving stream, reveals several anomalies.

Several parameters were detected frequently in the CPFP effluent but were less frequently detected instream. Pentachlorophenol was detected frequently in the effluent at relatively high levels, however, it was detected in only 4 of the 25 receiving water samples and only at trace levels. There is no apparent reason for the low frequency of detection instream. Further sampling is required to examine this phenomena. The fatty, aromatic and several resin acids listed in Table 4.4 were also detected infrequently instream. Effluent levels for these parameters were relatively low in comparison to the detection level, thus mixing with the receiving water lowered concentrations below the detection level. Dichloromethane and Dichlorobromomethane were also detected at low levels in the effluent and consequently would also be detected less frequently instream due to mixing with the receiving water.

Copper and Vanadium were the only parameters detected frequently instream but were detected infrequently in the CPFP discharge. It should be noted that CPFP utilizes the Kaministiquia River for water supply, thus these two parameters which are present above the water intake would be expected to occur in the effluent. The magnitude of instream concentrations of these two parameters are marginally above the detection limits for clean samples, and thus are significantly below detection limits for the dirty samples from the effluent sampling.

6.0 EFFLUENT LIMITS

Section 4.0 of this report presented study results which characterized the point source dischargers in terms of parameter detection and concentration levels. While not neglecting the importance of characterizing effluent discharges, the true measure of environmental impact, for the purposes of this report, is assessed based on receiving water analysis as described in Section 5.0. This section then will utilize the results of both sections and attempt to ascertain which parameters exceeded criteria levels and what amount of reduction in effluent loads would be required to achieve criteria levels in the receiving water.

As described earlier the emphasis of this study is to examine the impact of CPFP on the lower Kaministiquia River. Much of the discussion and analysis in this section will focus on CPFP. The other point source dischargers will be analysed in less detail. This is also a necessity imposed by the survey design. Less sampling at the other point sources makes it difficult to project what effluent limits are required.

Results listed in Table 5.4 identified frequently detected parameters in the lower Kaministiquia River. One of the first steps in the analysis is to compare detected concentrations with criteria levels. The criteria were generally taken from the "Blue Book" (MOE, 1984). This publication also describes several policies of MOE in dealing with surface water quality management. Two of the policies that will be used in setting effluent limits are as follows:

Policy 1: In areas which have water quality better than the Provincial Water Quality Objectives, water quality shall be maintained at or above the Objectives.

Policy 2: Water quality which presently does not meet the Provincial Water Quality Objectives shall not be degraded further and all practical measures shall be taken to upgrade the water quality to the Objectives.

Additionally the "Blue Book" also specifies a policy for dealing with mixing zones. A mixing zone is defined as an area of water contiguous to a point source where the water quality does not comply with the Provincial Water Quality Objectives. For this report a distinction will be made between the physical and regulatory mixing zones. The Physical Mixing Zone (PMZ) is the actual zone of mixing between the effluent plume and the ambient environment. The Regulatory Mixing Zone (RMZ) are a set of design conditions which are used by the Ministry to derive effluent limits. RMZ criteria are designed to ensure that the extent of the PMZ is minimized, and can be specified either on an areal (i.e. 1/3 stream width) or a volumetric (i.e. 25% of available stream flow) basis. For this report an RMZ of 25% of available stream flow will be utilized to determine effluent limits. For comparison purposes calculations will also be performed with an RMZ of 100%, which would allocate the entire receiving water to a point source discharger.

Effluent limits will be determined by mass balance as follows:

$$Cm = \frac{(Ce \times Qe) + (Cr \times Qr)}{Qe + Qr} \qquad (1)$$

where;

Cm - instream mixed concentration
Ce - effluent concentration
Cr - receiving water background concentration
Qe - effluent flow
Qr - receiving water background flow

Concentration and load limits will be determined by setting Cm equal to the receiving water criterion and rearranging equation (1) as follows:

$$Ce \times Qe = Cm\ (Qe + Qr) - (Cr \times Qr) \qquad (2)$$

The left hand side of equation (2) can then be compared with the existing

effluent load and load reductions will be determined. With the RMZ set to 25%, Qr will be reduced accordingly (i.e.: river flow available for mixing = Qr x 0.25).

Cross-stream sampling was carried out at stations B, K and P for conventional parameters to determine the lateral extent of the mixing zones for CPFP, OM and the Thunder Bay STP. Analysis results were reported earlier (Klose, 1988) and showed no significant cross-stream gradients. This was not an unexpected result as CPFP utilizes a diffuser outfall located on the river bottom. Studies by McCrimmon et al., 1988, have shown in fact that significant concentration gradients exist at the CPFP outfall in a vertical direction. Figure 6.1 provides a schematic representation. The concept of a volumetric RMZ still applies to this situation.

The Thunder Bay STP also utilizes an outfall located on the river bottom and thus cross-stream gradients are difficult to detect. Ogilvie Mills on the other hand utilizes a bank outfall at the river surface. The lack of cross-stream concentration gradients is likely due to the relatively small load from the mill.

6.1 The Canadian Pacific Forest Products Company

Mass balance predictions of instream concentrations are presented in Figure 6.2 utilizing 100% of the streamflow and the grab or composite sample results as indicated. It is evident that the predictions for 2,4,6 Trichlorophenol (TCP) and Total Resin Acids (TRA) are poor. Predictions for the remaining parameters, DeHydroabietic Acid (DHA), Chloroform, Iron, Aluminum, Chromium and Zinc, are acceptable.

Load and concentration reductions are listed in Table 6.1 along with the existing load. Results are presented utilizing both the median (50th percentile) and the 75th percentile effluent concentrations measured during the study. The receiving water flow rate utilized was 20 m^3/s as described earlier (see Section 5.0), while the effluent flow rates utilized were those measured during the survey (see Table 4.1).

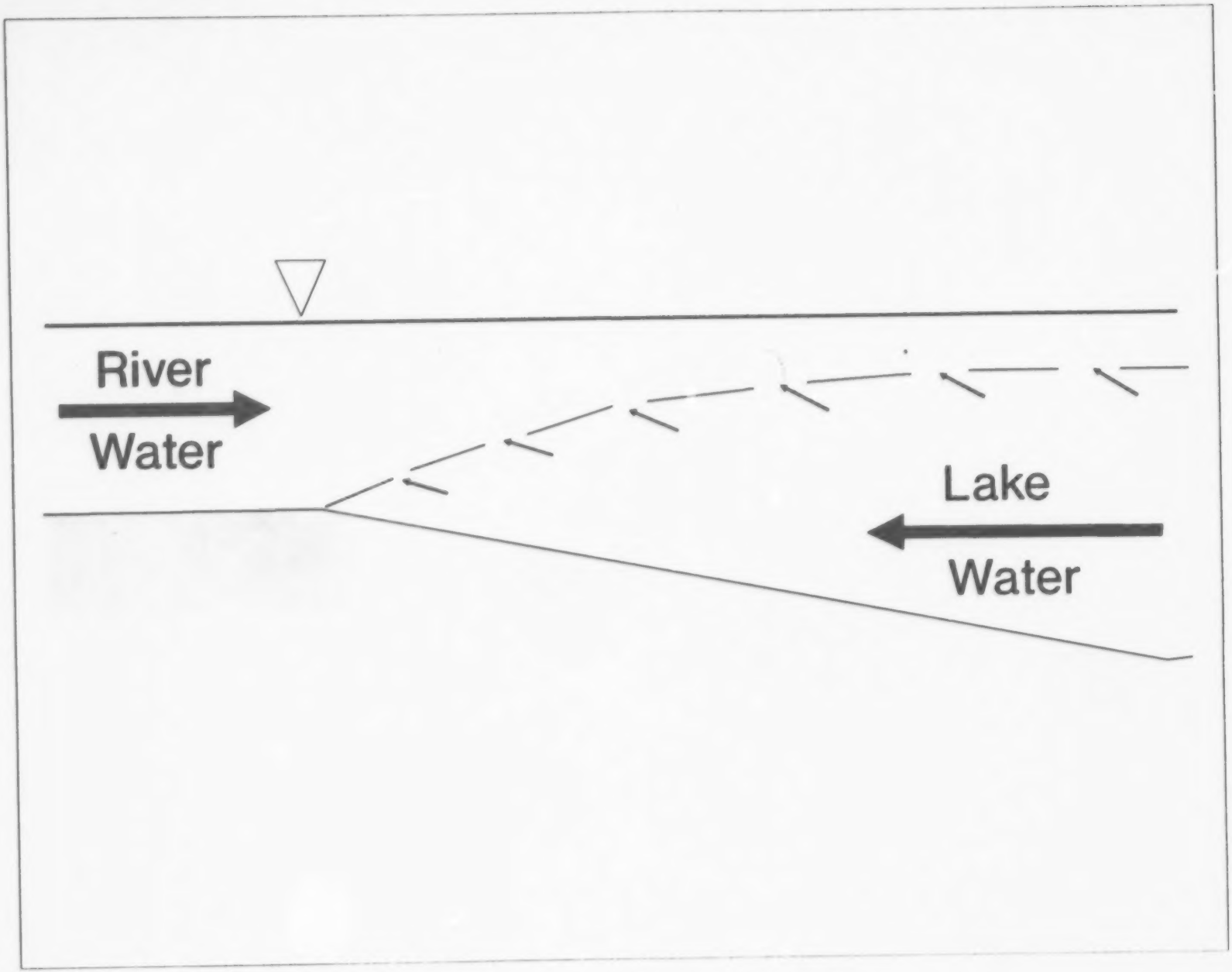


FIGURE 6.1: Schematic Diagram of Lakewater Intrusion

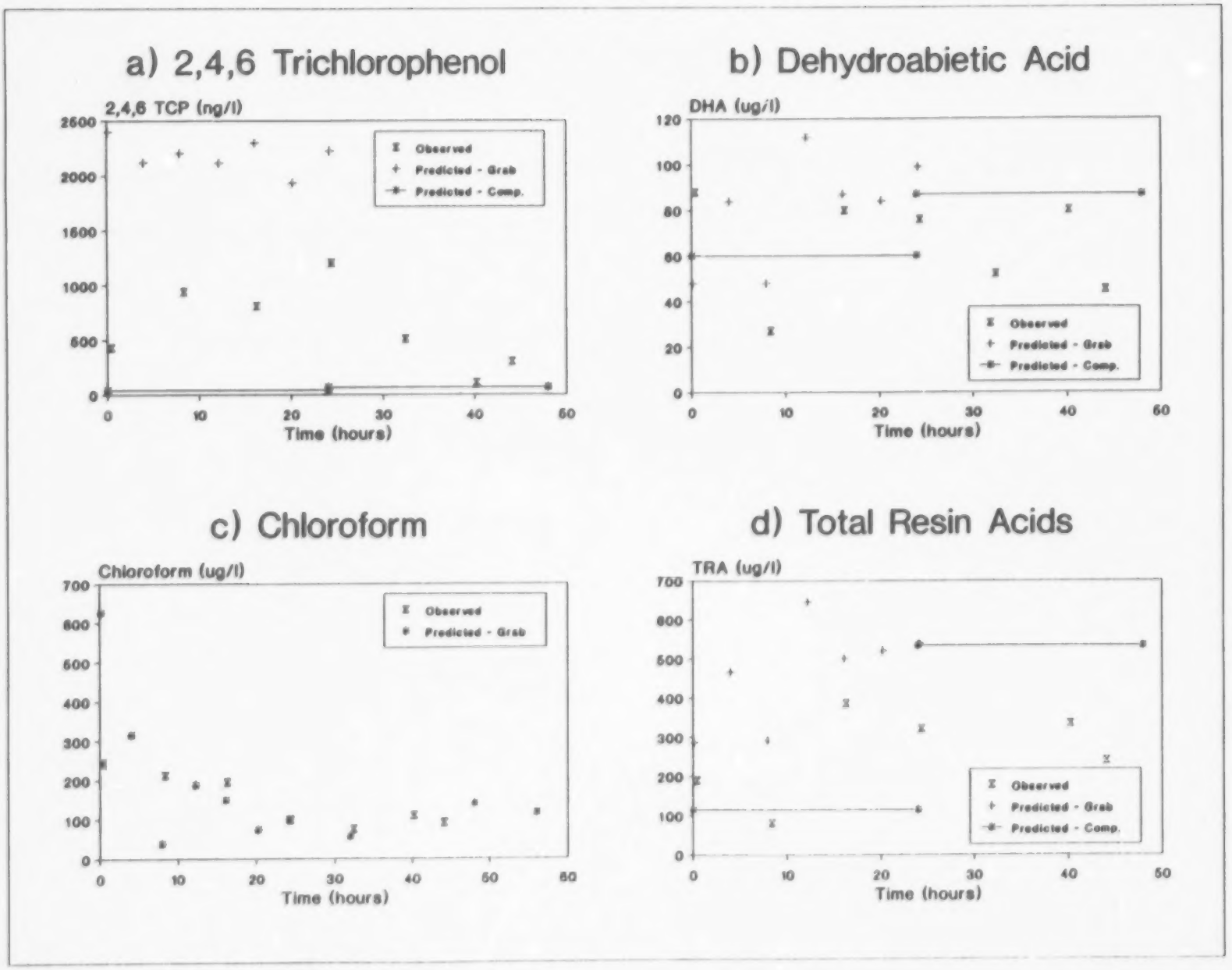


FIGURE 6.2: CPFP - Mass Balance Predictions

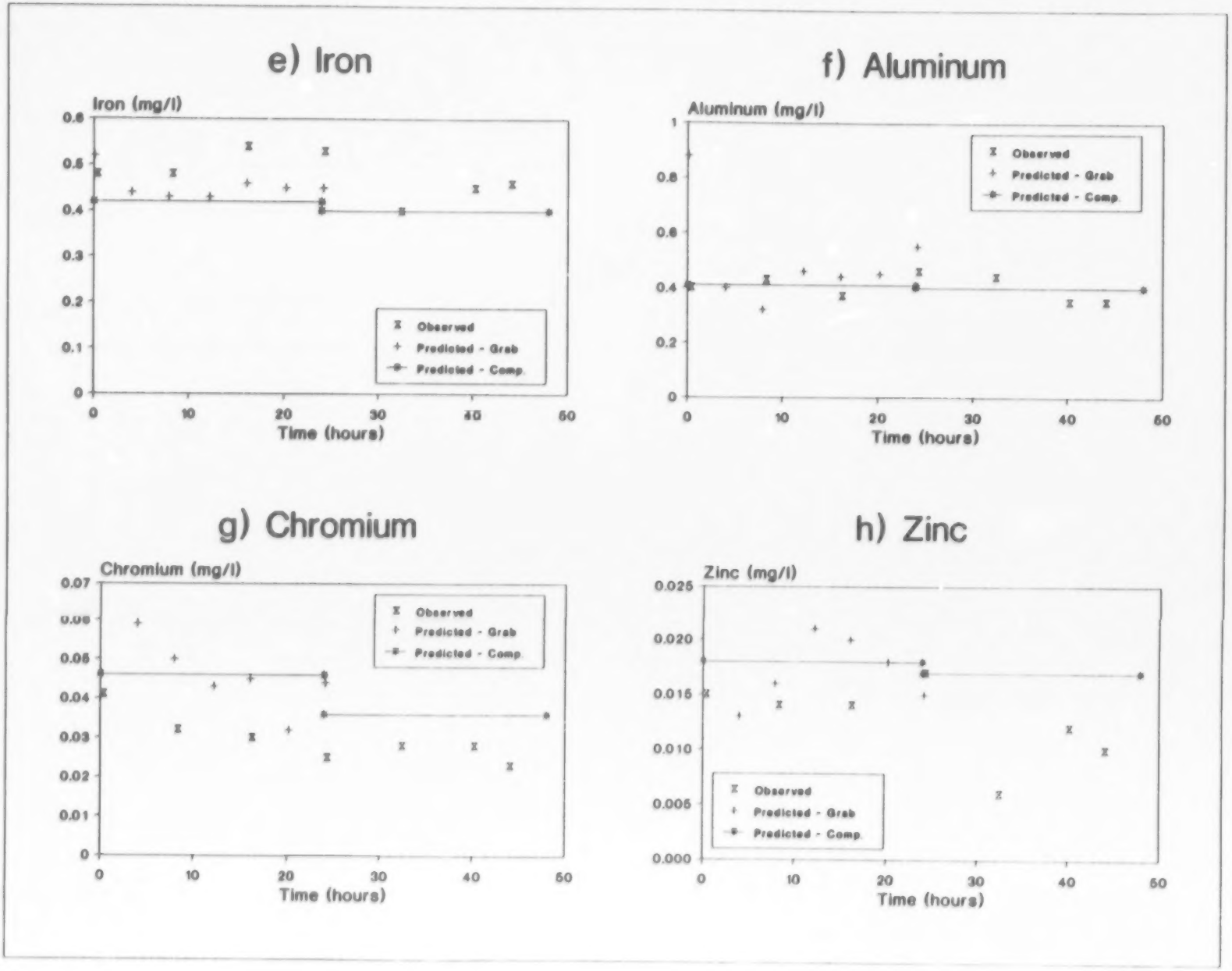


FIGURE 6.2: CPFP - Mass Balance Predictions (Continued)

Chloroform and 2,4,6 TCP do not require any reduction in existing loads. This is not unexpected as instream concentrations were well below criteria levels. DHA and TRA on the other hand require significant reductions in existing loads. There is very little difference in the reductions required between the 100% RMZ and 25% RMZ criteria due to the overall magnitude of load reductions.

Aluminum and Iron both equalled or exceeded criteria levels at Station A and thus are considered as Policy 2 parameters prior to the impact of CPFP. Policy 2 requires that no further reduction in quality be allowed, thus mass balance calculations as described in equation (2) need not be performed. Load reductions were determined by setting the effluent concentration equal to the median background concentration which equalled the criteria levels. CPFP uses the Kaministiquia River as its supply, therefore these reductions are not likely achievable without a concurrent improvement in the background water quality.

Instream chromium concentrations did not exceed criterion levels while zinc had only two measurements above the criterion. Under the 100% RMZ both parameters require no reduction in existing load. With the 25% RMZ reductions of approximately 20% to 30% are required. It should be noted that in figure 6.1 station D results were used to compare with the predicted concentrations for chromium. As was shown in section 4.0 a major portion of the chromium load originates from the B outfall. Due to the proximity of the B outfall to station B, complete mixing of the B outfall effluent and the receiving water occurs further downstream as was shown in Figure 5.2.

Pentachlorophenol (PCP) was detected frequently in the CPCP discharge (see Table 4.4) at significant levels in the A outfall. In the receiving water however, PCP was detected in only 4 of the 25 samples at trace levels. Mass balance calculations indicate that PCP should have been detected instream at levels above the criterion. The reason for this anomaly cannot be determined from the present information. Predicted load reductions for PCP from the existing load of 2.3 kg/day, based on the median effluent

TABLE 6.1: CPFP EFFLUENT LIMITS*

Parameter	Existing Load (kg/day)	Effluent Reduction (%)					
		100% RMZ			25% RMZ		
		Load Reduction	Concentration Reduction		Load Reduction	Concentration Reduction	
			A Outfall	B Outfall		A Outfall	B Outfall
2,4,6 TCP	3.3/3.8	0/0	0/0	0/0	0/0	0/0	0/0
DHA	150/168	91/92	91/92	-/-	97/97	97/97	-/-
TRA	864/931	91/92	95/95	-/-	98/98	98/98	-/-
Chloroform	223/528	0/0	0/0	0/0	0/0	0/0	0/0
** Iron	332/345	77/78	84/84	0/14	NA	NA	NA
** Aluminum	617/776	96/98	97/98	37/47	NA	NA	NA
Chromium	77/86	0/0	0/0	-/-	19/28	23/29	18/27
Zinc	26/28	0/0	0/0	-/-	32/36	32/36	-/-

*Note: Results presented utilizing both median (50th percentile) and 75th percentile effluent concentrations along with flows reported earlier (Klose, 1988), as follows: 50th percentile based number/75th percentile based number.

\- Undetected, existing concentration assumed to be zero.

** Policy 2 parameters prior to CPFP discharge. Reductions based on effluent concentrations being reduced to background levels.

NA Not Applicable.

concentration, are 63% for the 100% RMZ scenario and 86% for the 25% RMZ scenario.

6.2 Reichhold Chemical Ltd, Ogilvie Mills and Thunder Bay Sewage Treatment Plant

Iron was the only parameter of those detected in the Reichhold Chemical effluent that exceeded criterion levels in the study area (see Tables 4.9 and 5.4). Detected effluent concentrations exceeded the criterion in only one of the samples. No reductions in iron discharge are required.

Dehydroabietic Acid (DHA) and iron were the only two parameters that were detected in the Ogilvie Mills effluent that exceeded criteria levels in the study area (see Tables 4.11 and 5.4). There were insufficient detections of DHA to determine if reductions are required. Iron is a Policy 2 parameter prior to the OM discharge, thus the calculated reduction in median effluent loading of 76% is based on reducing the effluent concentration to background levels. Copper and Zinc were both detected at elevated levels in the effluent discharge, however no reductions in median loadings are required even with the RMZ set at 25% of the available stream flow.

Iron and aluminum are the only two parameters that were detected in the Thunder Bay Sewage Treatment Plant effluent that exceeded criteria levels in the study area (see Tables 4.13 and 5.4). Insufficient detections of aluminum does not allow the determination of effluent concentration reductions. Iron is a Policy 2 parameter prior to the effluent discharge, thus the calculated effluent loading reduction of 95% is based on reducing the median effluent concentration to background levels. Copper was detected at elevated levels in the effluent discharge and requires a 54% median load reduction for the 100% RMZ scenario and a 71% median load reduction for the 25% RMZ scenario.

7.0 CONCLUSIONS

- Of the 129 parameters that were analysed in samples collected from the Canadian Pacific Forest Products (CPFP) effluent, eleven parameters were detected frequently (ie., > 25% of the samples) and above receiving water criteria values. The parameters were; 2,4,6 Trichlorophenol, Pentachlorophenol, Dehydroabietic Acid, Total Resin Acids, Chloroform, Iron, Manganese, Aluminum, Chromium, Mercury and Zinc. Receiving water criteria though not directly applicable to effluent concentration levels, were used as a screen to identify parameters of potential concern.

- A comparison of composite and grab sample results for the CPFP samples shows a good level of correlation for the trace metals and resin acids parameters, and a poor correlation for the two chlorophenol parameters.

- The majority of the effluent contaminant load from CPFP with the exception of chromium, is discharged in the A outfall.

- Iron was the only parameter of those measured in the Reichhold Chemical (RC) discharge that was detected frequently above receiving water criteria.

- Eleven parameters were detected above receiving water criteria levels in the Oglivie Mills (OM) discharge. They were; Heptachlor, pp-DDE, pp-DDD, Endosulfan II, Dieldrin, Endrin, Dehydroabietic Acid, Iron, Managanese, Copper, and Zinc. The detection of these parameters is likely tied to a treatment system breakdown at OM during the survey period.

- Effluent sampling at the Thunder Bay Sewage Treatment Plant (STP), detected seven parameters above receiving water criteria. They were; ɣ-BHC, op-DDT, Benzo (A) Pyrene, Iron, Mangenese, Aluminum, and Copper.

- Twenty-seven parameters were detected infrequently (< 25% of the samples), and thirteen were detected frequently (> 25% of the samples) of the 111 parameters sampled at 12 stations within the lower Kaministiquia River. Aldrin, Cadmium and Lead were the only infrequently detected parameters that were above criteria levels. Of the 9 frequently detected parameters for which a receiving water criterion exists, Dehydroabietic Acid, Total Resin Acids, Iron and Aluminum were above criteria levels. The remaining parameters, 2,4,6 Trichlorophenol, Chloroform, Copper, Chromium and Zinc were below criteria levels.

- An examination of the spatial trends showed that the lower Kaministiquia River is dominated by the CPFP discharge.

- Mass balance calculations, including mixing zone considerations, yielded the effluent load reductions required to achieve criteria levels instream as follows:

CPFP

2,4,6 Trichlorophenol and chloroform	0%
Pentachlorophenol	> 60%
Dehydoabietic Acid and Total Resin Acids	> 90%
Iron	> 75%
Aluminum	> 95%
Chromium and Zinc	20-30%

RC

No reductions

OM

Iron	> 75%

STP

Iron	> 90%
Copper	> 50%

- It should be noted that Iron and Aluminum exceeded receiving water criteria at the upstream end of the study area, thus load reduction predictions are based on reducing effluent concentrations to background levels.

REFERENCES

Beak, 1986 "Aquatic Environmental Studies - Post-operational Study, 1985/86", Thunder Bay Generating Station Extension, A report for Ontario Hydro, 1986.

CCREM, 1987 "Canadian Water Quality Guidelines", Canadian Council of Resource and Environment Ministers, March 1987.

Chambers, J.M., W.S. Cleveland, B. Kleiner and P. Tukey, "Graphical Methods for Data Analysis", 1983.

Klose, S. "Kaministiquia River Water Quality Study - Part 1: Waste Assimilation Capacity", Ontario Ministry of the Environment, February 1988.

McCrimmon, R.C., D.C.L. Lam, Z. Novak and S. Klose, "Simulation of the Thermal Structure of Kaministiquia River, Thunder Bay, Ontario", Ontario Ministry of the Environment, September 1988.

McCrimmon, R.C., D.C.L. Lam, S. Klose and Z. Novak, "Modelling Oxygen Depletion in the Kaministiquia River, Thunder Bay, Ontario", Ontario Ministry of the Environment, September 1988.

Michigan, 1984 "Support Document for the Proposed Rule 57 Package", Michigan Department of Natural Resources, Environmental Protection Bureau, March 1984.

MOE, 1972, "Thunder Bay - Regional Water Quality Survey", September, 1972.

MOE, 1980, "Stream Water Quality Assessment Procedures Manual", March, 1980.

MOE, 1984, "Water Management - Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment", Revised May, 1984.

MOE, 1986, "Municipal - Industrial Strategy for Abatement (MISA)", June 1986.

Murphy, J., MOE, N.W. Region, personal communication June 1988.

APPENDIX A:

PARAMETER LISTING

ORGANOCHLORINE

PCB
Hexachlorobenzene
Heptachlor
Aldrin
pp-DDE
Mirex
a-BHC
b-BHC
g-BHC
a-chlordane
g-chlordane
Oxychlordane
op-DDT
pp-DDD
pp-DDT
DMDT Methoxychylor
Heptachlorepoxide
Endosulfan I
Endosulfan II
Dieldrin
Endrin
Endosulfan Sulphate
Octachlorostyrene

CHLOROBENZENES

Hexachloroethane
135 Trichlorobenzene
124 Trichlorobenzene
Hexachlorobutadiene
123 Trichlorobenzene
245 Trichlorotoluene
236 Trichlorotoluene
1235 Tetrachlorobenzene
1245 Tetrachlorobenzene
26a Trichlorotoluene
1234 Tetrachlorobenzene
Pentachlorobenzene

CHLORINATED PHENOLS

246 Trichlorophenol
245 Trichlorophenol
234 Trichlorophenol
2356 Tetrachlorophenol
2345 Tetrachlorophenol
Pentachlorophenol

PHENOXY ACIDS

Dicamba
24D Propionic Acid
24 Dichlorophenoxyacetic
Silvex
245 Trichlorophenoxyacetic
24 Dichlorophenoxybutyrc
Picloram

FATTY ACIDS

Capric
Lauric
Myristic
Palmitic
Stearic
Oleic
Linoleic
Arachidic

AROMATIC ACIDS

Benzoic
Salicylic
Phthalic
Palustric

RESIN ACIDS

Pimaric
Sandaracopimaric
Levopimaric
Isopimaric
Neoabietic
Abietic
Dehydroabietic

SPECIATED PHENOLICS

Phenol
Vanillin
Homovanillic Acid
Guaicol
Syringaldehyde
Acetovanillone
Acetosyringone

VOLATILES

11 Dichloroethylene
Dichloromethane
12 Dichloroethylene
11 Dichloroethane
Chloroform
111 Trichloroethane
12 Dichloroethane
Carbontetrachloride
Benzene
Trichloroethylene
Dichlorobromomethane
Toluene
112 Trichloroethane
Chlorodibromomethane
Tetrachloroethlyene
Chlorobenzene
Trifluorochlorotoluene
Ethylbenzene
Ethylene Dibromide
M & P Xylenes
Bromoform
O-xylene
1122 Tetrachloroethane
14 Dichlorobenzene
13 Dichlorobenzene
12 Dichlorobenzene

POLYNUCLEAR AROMATIC HYDROCARBONS

Phenanthrene
Anthracene
Fluoranthene
Pyrene
Benz(A) Anthracene
Chrysene
Dimeth. Benz (A) Anthracene
Benzo (E) Pyrene
Benzo (J) Fluoranthene
Perylene
Benzo (K) Fluoranthene
Benzo (A) Pyrene
Benzo (G,H,I) Perylene
Dibenz (A,H) Anthracene
Indeno (1,2,3-C,D) Pyrene
Benzo (B) Chrysene

METALS

Iron
Manganese
Aluminum
Beryllium
Cadmium
Cobalt
Chromium
Copper
Mercury
Nickel
Lead
Strontium
Vanadium
Zinc

APPENDIX B:

EFFLUENT SAMPLING RESULTS

Note: 1) Results presented by individual discharge point and sampling program.

2) Remark codes are described in Section 3.1, Table 3.1.

CANADIAN PACIFIC FOREST PRODUCTS

COMPOSITE SAMPLES - A OUTFALL

Sample Number	1	2	3	4	5	6	7
Date	860809	860810	860811	860812	860813	860814	860815
Time	12:00	12:00	12:00	12:00	12:00	12:00	12:00
Organochlorine (ng/l)							
PCB	20<W	20<W	20<W	RO!	20<W	20<W	IS!
Hexachlorobenzene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Heptachlor	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Aldrin	1<W	1<W	1<W	RO!	1<W	1<W	IS!
pp-DDE	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Mirex	5<W	5<W	5<W	RO!	5<W	5<W	IS!
a-BHC	1<W	1<W	1<W	RO!	1<W	1<W	IS!
b-BHC	1<W	1<W	1<W	RO!	1<W	1<W	IS!
g-BHC	1<W	1<W	1<W	RO!	1<W	1<W	IS!
a-chlordane	2<W	2<W	2<W	RO!	2<W	2<W	IS!
g-chlordane	2<W	2<W	2	RO!	95	58	IS!
Oxychlordane	2<W	2<W	2<W	RO!	2<W	2<W	IS!
op-DDT	5<W	5<W	5<W	RO!	70	5<W	IS!
pp-DDD	5<W	5	5<W	RO!	80	45	IS!
pp-DDT	5<W	5<W	5<W	RO!	5<W	5<W	IS!
DMDT Methoxychlor	5<W	5<W	5<W	RO!	5<W	5<W	IS!
Heptachlorepoxide	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Endosulfan I	2<W	2<W	2<W	RO!	2<W	2<W	IS!
Endosulfan II	4<W	4<W	4<W	RO!	4<W	4<W	IS!
Dieldrin	2<W	14	2<W	RO!	2<W	2<W	IS!
Endrin	4<W	4	4<W	RO!	4<W	4<W	IS!
Endosulfan Sulphate	4<W	4<W	4<W	RO!	4<W	4<W	IS!
Octachlorostyrene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Chlorobenzene (ng/l)							
Hexachloroethane	1<W	1<W	1<W	RO!	1<W	1<W	IS!
135 Trichlorobenzene	2<W	2<W	2<W	RO!	2<W	2<W	IS!
124 Trichlorobenzene	2<W	2<W	2<W	RO!	2<W	2<W	IS!
Hexachlorobutadiene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
123 Trichlorobenzene	2<W	2<W	2<W	RO!	2<W	2<W	IS!
245 Trichlorotoluene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
236 Trichlorotoluene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
1235 Tetrachlorobenzene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
1245 Tetrachlorobenzene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
26a Trichlorotoluene	1<W	1<W	1<W	RO!	91	11	IS!
1234 Tetrachlorobenzene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Pentachlorobenzene	1<W	1<W	1<W	RO!	1<W	1<W	IS!
Chlorinated Phenols (ng/l)							
246 Trichlorophenol	15000	20000	20000	340<T	50<W	30000	3600
245 Trichlorophenol	50<W	50<W	50<W	850	26000	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W	100<W	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W	60<T	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W	210<T	50<W	50<W	50<W
Pentachlorophenol	810	1050	1500	CS!	28000	44000	730
Phenoxy Acids (ng/l)							
Dicamba	100<W	100<W	100<W	RO!	100<W	100<W	100<W
24D Propionic Acid	100<W	100<W	100<W	RO!	100<W	100<W	100<W
24 Dichlorophenoxyacetic	100<W	100<W	100<W	RO!	200	100<W	100<W
Silvex	50<W	50<W	50<W	RO!	50<W	50<W	50<W
245 Trichlorophenoxyacetic	50<W	50<W	50<W	RO!	50<W	50<W	50<W
24 Dichlorophenoxybutyrc	200<W	200<W	200<W	RO!	200<W	200<W	200<W
Picloram	100<W	100<W	100<W	RO!	100<W	100<W	100<W
Fatty Acids (ug/l)							
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	11	10<W	10<W	10<W	13
Palmitic	10<W	23	50	19	20	25	10<W
Stearic	16	10<W	190	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	215	31	10<W	10<W	10<W
Arachidic	10<W	24	10<W	14	21	10<W	19

Aromatic Acids (ug/l)

Benzoic	10<W	100	105	48	26	42	36
Salicylic	10<W	10<W	10<W	1128	1140	1400	1084
Phthalic	10<W	10<W	10<W	10<W	10<W	32	10<W

Resin Acids (ug/l)

Pimaric	10<W	80	120	50	86	110	68
Sandaracopimaric	10<W	95	150	67	101	126	76
Levopimaric/Palustric	10<W	340	635	96	560	685	175
Isopimaric	10<W	210	295	137	243	300	200
Neoabietic	10<W	150	330	105	441	500	156
Abietic	10<W	3470	4850	130	3240	3240	2465
Dehydroabietic	10<W	1020	1270	625	910	910	910

Speciated Phenolics (ug/l)

Phenol	LA!	LA!	IS!	SM!	LA!	1<W	1<W
Vanillin	LA!	LA!	IS!	SM!	LA!	1<W	1<W
Homovanillic Acid	LA!	LA!	IS!	SM!	LA!	1<W	1<W
Guaicol	LA!	LA!	IS!	SM!	LA!	1<W	1<W
Syringaldehyde	LA!	LA!	IS!	SM!	LA!	1<W	1<W
Acetovanillone	LA!	LA!	IS!	SM!	LA!	1<W	1<W
Acetosyringone	LA!	LA!	IS!	SM!	LA!	1<W	1<W

Polynuclear Aromatic Hydrocarbons (ng/l)

Phenanthrene	0<W	0<W	10-50	SM!
Anthracene	0<W	0<W	1-5	SM!
Fluoranthene	0<W	0<W	2-10	SM!
Pyrene	0<W	0<W	0<W	SM!
Benz(A)Anthracene	0<W	0<W	0<W	SM!
Chrysene	0<W	0<W	0<W	SM!
Dimeth.Benz(A)Anthracene	0<W	0<W	0<W	SM!
Benzo(E) Pyrene	0<W	0<W	0<W	SM!
Benzo(J)Fluoranthene	0<W	0<W	0<W	SM!
Benzo(B)Fluoranthene	0<W	0<W	0<W	SM!
Perylene	0<W	0<W	0<W	SM!
Benzo(K)Fluoranthene	0<W	0<W	0<W	SM!
Benzo(A) Pyrene	0<W	0<W	0<W	SM!
Benzo(G,H,I)Perylene	0<W	0<W	0<W	SM!
Indeno(1,2,3-C,D)Pyrene	0<W	0<W	0<W	SM!
Benzo(B)Chrysene	0<W	0<W	0<W	SM!

Trace Metals (mg/l)

Iron	2.5	1.9	<1.9	1.6	1.4	1.4	NR!
Manganese	0.9	1.0	0.94	0.96	0.93	0.96	NR!
Aluminum	5.1	4.5	4.6	3.2	3.2	3.1	NR!
Beryllium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NR!
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NR!
Cobalt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NR!
Chromium	0.18	0.13	0.12	0.15	0.13	<0.10	NR!
Copper	<0.10	<0.10	<0.10	<0.10	0.28	<0.10	NR!
Mercury (ug/l)	0.1	0.05	0.07	0.05	0.08	0.06	0.06
Nickel	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NR!
Lead	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NR!
Strontium	0.18	0.17	0.17	0.18	0.35	0.17	NR!
Vanadium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	NR!
Zinc	0.13	0.12	0.12	0.17	0.16	0.18	NR!

Sample	1A	1B	2A	2B	3A	3B
Date	860809	860809	860810	860810	860811	860811
Time	14:00	20:00	12:00	20:00	12:00	16:00
Volatiles (ug/l)						
11 Dichloroethylene	SMI	SMI	SMI	SMI	20<W	20<W
Dichloromethane	SMI	SMI	SMI	SMI	110	120
12 Dichloroethylene	SMI	SMI	SMI	SMI	20<W	20<W
11 Dichloroethane	SMI	SMI	SMI	SMI	20<W	20<W
Chloroform	SMI	SMI	SMI	SMI	7060	3660
111 Trichloroethane	SMI	SMI	SMI	SMI	20<W	20<W
12 Dichloroethane	SMI	SMI	SMI	SMI	20<W	20<W
Carbontetrachloride	SMI	SMI	SMI	SMI	20<W	20<W
Benzene	SMI	SMI	SMI	SMI	20<W	20<W
Trichloroethylene	SMI	SMI	SMI	SMI	20<W	20<W
Dichlorobromomethane	SMI	SMI	SMI	SMI	20<W	20<W
Toluene	SMI	SMI	SMI	SMI	20<W	20<W
112 Trichloroethane	SMI	SMI	SMI	SMI	20<W	20<W
Chlorodibromomethane	SMI	SMI	SMI	SMI	20<W	20<W
Tetrachloroethylene	SMI	SMI	SMI	SMI	20<W	20<W
Chlorobenzene	SMI	SMI	SMI	SMI	20<W	20<W
Trifluorochlorotoluene	SMI	SMI	SMI	SMI		
Ethylbenzene	SMI	SMI	SMI	SMI	20<W	20<W
Ethylene Dibromide	SMI	SMI	SMI	SMI		
M & P Xylenes	SMI	SMI	SMI	SMI	20<W	20<W
Bromoform	SMI	SMI	SMI	SMI	20<W	20<W
O-xylene	SMI	SMI	SMI	SMI	20<W	20<W
1122 Tetrachloroethane	SMI	SMI	SMI	SMI	20<W	20<W
14 Dichlorobenzene	SMI	SMI	SMI	SMI	20<W	40<T
13 Dichlorobenzene	SMI	SMI	SMI	SMI	20<W	20<W
12 Dichlorobenzene	SMI	SMI	SMI	SMI	20<W	20<W

Sample	5A	5B	6A	6B	7A	7B
Date	860813	860814	860814	860814	860815	860815
Time	20:00	04:00	12:00	20:00	12:00	20:00
Volatiles (ug/l)						
11 Dichloroethylene	10<W	1<W	10<W	10<W	10<W	SMI
Dichloromethane	33<T	1<W	47<T	58<T	41<T	SMI
12 Dichloroethylene	10<W	1<W	10<W	10<W	10<W	SMI
11 Dichloroethane	10<W	1<W	10<W	10<W	10<W	SMI
Chloroform	584	390	1117	1026	244	SMI
111 Trichloroethane	10<W	1<W	10<W	10<W	10<W	SMI
12 Dichloroethane	10<W	1<W	10<W	10<W	10<W	SMI
Carbontetrachloride	10<W	1<W	10<W	10<W	10<W	SMI
Benzene	10<W	1<W	10<W	10<W	10<W	SMI
Trichloroethylene	10<W	1<W	10<W	10<W	10<W	SMI
Dichlorobromomethane	10<W	13	10<W	10<W	10<W	SMI
Toluene	10<W	1<W	10<W	10<W	10<W	SMI
112 Trichloroethane	10<W	1<W	10<W	10<W	10<W	SMI
Chlorodibromomethane	10<W	1<W	10<W	10<W	10<W	SMI
Tetrachloroethylene	10<W	1<W	10<W	10<W	10<W	SMI
Chlorobenzene	10<W	1<W	10<W	10<W	10<W	SMI
Trifluorochlorotoluene	10<W	1<W	10<W	10<W	10<W	SMI
Ethylbenzene	10<W	1<W	10<W	10<W	10<W	SMI
Ethylene Dibromide	10<W	1<W	10<W	10<W	10<W	SMI
M & P Xylenes	10<W	1<W	10<W	10<W	10<W	SMI
Bromoform	10<W	1<W	10<W	10<W	10<W	SMI
O-xylene	10<W	1<W	10<W	10<W	10<W	SMI
1122 Tetrachloroethane	10<W	1<W	10<W	10<W	10<W	SMI
14 Dichlorobenzene	10<W	1<W	68<T	186	313	SMI
13 Dichlorobenzene	10<W	1<W	10<W	10<W	10<W	SMI
12 Dichlorobenzene	10<W	1<W	10<W	10<W	10<W	SMI

CANADIAN PACIFIC FOREST PRODUCTS

GRAB SAMPLES - A OUTFALL

Sample Number	7	8	9	10	11	12	13
Date	860812	860812	860812	860813	860813	860813	860813
Time	12:00	15:50	19:50	00:04	04:00	08:05	12:00
Chlorinated Phenols (ng/l)							
246 Trichlorophenol	25000	22000	23000	22000	24000	20000	23000
245 Trichlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W	100<W	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
Pentachlorophenol	19000	22000	14000	22000	30000	50<W	24000
Fatty Acids (ug/l)							
Capric	10<W	30	17	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	15	14
Palmitic	11	25	22	28	31	20	34
Stearic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	10<W	10<W	10<W	10<W	100
Arachidic	12	10<W	25	10<W	24	30	10<W
Aromatic Acids (ug/l)							
Benzoic	34	10<W	10<W	120	115	85	97
Salicylic	863	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Resin Acids (ug/l)							
Pimaric	43	83	80	100	73	65	84
Sandaracopimaric	52	87	75	110	110	100	106
Levopimaric/Palustric	450	270	190	380	350	440	340
Isopimaric	150	190	180	280	210	225	242
Neoabietic	130	250	350	190	115	295	383
Abietic	1675	3130	1675	4530	3470	3425	3430
Dehydroabietic	500	875	500	1170	910	885	1040
Speciated Phenolics (ug/l)							
Phenol	LA!	LA!	IS!	LA!	SM!	SM!	3<T
Vanillin	LA!	LA!	IS!	LA!	SM!	SM!	2<T
Homovanillic Acid	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Guaicol	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Syringaldehyde	LA!	LA!	IS!	LA!	SM!	SM!	3<T
Acetovanillone	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Acetosyringone	LA!	LA!	IS!	LA!	SM!	SM!	1<W

Volatiles (ug/l)

11 Dichloroethylene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Dichloromethane	37<T	53<T	2<T	40<T	69<T	84<T	23<T
12 Dichloroethylene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
11 Dichloroethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Chloroform	6130	2813	102	1961	1335	733	787
111 Trichloroethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
12 Dichloroethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Carbontetrachloride	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Benzene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Trichloroethylene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Dichlorobromomethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Toluene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
112 Trichloroethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Chlorodibromomethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Tetrachloroethylene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Chlorobenzene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
Trifluorochlorotoluene					10<W	10<W	10<W
Ethylbenzene	10<W	54<T	1<W	10<W	10<W	10<W	10<W
Ethylene Dibromide					10<W	10<W	10<W
M & P Xylenes	12<T	242	1<W	10<W	10<W	10<W	10<W
Bromoform	10<W	10<W	1<W	10<W	10<W	10<W	10<W
O-xylene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
1122 Tetrachloroethane	10<W	10<W	1<W	10<W	10<W	10<W	10<W
14 Dichlorobenzene	10<W	10<W	11	174	55<T	149	215
13 Dichlorobenzene	10<W	10<W	1<W	10<W	10<W	10<W	10<W
12 Dichlorobenzene	10<W	10<W	1<W	10<W	10<W	10<W	10<W

Trace Metals (mg/l)

Iron	2.5	1.8	1.7	1.7	1.9	1.9	1.8
Manganese	1.1	0.75	0.78	0.83	1	0.82	0.89
Aluminum	8.2	3.1	2.3	3.7	3.5	3.6	4.2
Beryllium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium	0.14	0.14	0.14	0.11	0.17	<0.10	0.11
Copper	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Mercury (ug/l)	0.04	0.05	0.01	0.04	0.01	0.05	0.43
Nickel	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Lead	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Strontium	0.18	0.16	0.16	0.16	0.19	0.16	0.15
Vanadium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Zinc	0.17	0.11	0.15	0.2	0.19	0.17	0.14

CANADIAN PACIFIC FOREST PRODUCTS

COMPOSITE SAMPLES - B OUTFALL

Sample Number	1	2	3	4	5	6	7
Date	860809	860810	860811	860812	860813	860814	860815
Time	12:00	12:00	12:00	12:00	12:00	12:00	12:00
Organochlorine (ng/l)							
PCB	20<W	20<W	20<W	20<W	20<W	20<W	20<W
Hexachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Heptachlor	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Aldrin	1<W	1<W	1<W	1<W	1<W	1<W	1<W
pp-DDE	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Mirex	5<W	5<W	5<W	5<W	5<W	5<W	5<W
a-BHC	1<W	1<W	1<W	1<W	1<W	1<W	1<W
b-BHC	1<W	1<W	1<W	1<W	1<W	1<W	1<W
g-BHC	1<W	1<W	1<W	1<W	1<W	1<W	1<W
a-chlordane	2<W	2<W	2<W	2<W	2<W	2<W	2<W
g-chlordane	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Oxychlordane	2<W	2<W	2<W	2<W	2<W	2<W	2<W
op-DDT	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDD	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDT	5<W	5<W	5<W	5<W	5<W	5<W	5<W
DMDT Methoxychlor	5<W	5<W	5<W	5<W	5<W	5<W	5<W
Heptachlorepoxide	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Endosulfan I	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endosulfan II	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Dieldrin	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endrin	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Endosulfan Sulphate	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Octachlorostyrene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Chlorobenzene (ng/l)							
Hexachloroethane	1<W	1<W	1<W	1<W	1<W	1<W	1<W
135 Trichlorobenzene	2<W	2<W	2<W	2<W	2<W	2<W	2<W
124 Trichlorobenzene	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Hexachlorobutadiene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
123 Trichlorobenzene	2<W	2<W	2<W	2<W	2<W	2<W	2<W
245 Trichlorotoluene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
236 Trichlorotoluene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1235 Tetrachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1245 Tetrachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
26a Trichlorotoluene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1234 Tetrachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Pentachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Chlorinated Phenols (ng/l)							
246 Trichlorophenol	730	200	500	200	1200	14000	470
245 Trichlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W	100<W	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
Pentachlorophenol	50<W	50<W	50<W	50<W	50	50<W	50<W
Phenoxy Acids (ng/l)							
Dicamba	100<W	100<W	100<W	100<W	100<W	100<W	100<W
24D Propionic Acid	100<W	100<W	100<W	100<W	100<W	100<W	100<W
24 Dichlorophenoxyacetic	100<W	100<W	100<W	100<W	100<W	100<W	100<W
Silvex	50<W	50<W	50<W	50<W	50<W	50<W	50<W
245 Trichlorophenoxyacetic	140	50<W	50<W	50<W	50<W	50<W	50<W
24 Dichlorophenoxybutyrc	200<W	200<W	200<W	200<W	200<W	200<W	200<W
Picloram	100<W	100<W	100<W	100<W	100<W	100<W	100<W
Fatty Acids (ug/l)							
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10	10<W	10<W	10<W	10<W
Palmitic	10<W	10<W	23	10<W	11	31	10<W
Stearic	10	12	130	10<W	26	47	10<W
Oleic/Linoleic	10<W	10<W	100	10<W	10<W	326	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Aromatic Acids (ug/l)

Benzoic	10<W	10<W	125	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	10<W	90	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	10<W	100	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	400	10<W	10<W	10<W	10<W
Isopimaric	10<W	10<W	230	10<W	10<W	10<W	11
Neoabietic	10<W	10<W	240	10<W	10<W	10<W	24
Abietic	10<W	10<W	3780	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	10<W	1040	10<W	10<W	10<W	29

Speciated Phenolics (ug/l)

Phenol	LA!	LA!	IS!	IS!	LA!	16	1<W
Vanillin	LA!	LA!	IS!	IS!	LA!	8<T	1<W
Homovanillic Acid	LA!	LA!	IS!	IS!	LA!	8<T	1<W
Guaicol	LA!	LA!	IS!	IS!	LA!	7<T	1<W
Syringaldehyde	LA!	LA!	IS!	IS!	LA!	1<W	1<W
Acetovanillone	LA!	LA!	IS!	IS!	LA!	10<T	1<W
Acetosyringone	LA!	LA!	IS!	IS!	LA!	1<W	1<W

Polynuclear Aromatic Hydrocarbons (ng/l)

Phenanthrene	0<W	0<W	0<W	0<W
Anthracene	0<W	0<W	0<W	0<W
Fluoranthene	0<W	0<W	0<W	0<W
Pyrene	0<W	0<W	0<W	0<W
Benz(A)Anthracene	0<W	0<W	0<W	0<W
Chrysene	0<W	0<W	0<W	0<W
Dimeth.Benz(A)Anthracene	0<W	0<W	0<W	0<W
Benzo(E) Pyrene	0<W	0<W	0<W	0<W
Benzo(J)Fluoranthene	0<W	0<W	0<W	0<W
Benzo(B)Fluoranthene	0<W	0<W	0<W	0<W
Perylene	0<W	0<W	0<W	0<W
Benzo(K)Fluoranthene	0<W	0<W	0<W	0<W
Benzo(A) Pyrene	0<W	0<W	0<W	0<W
Benzo(G,H,I)Perylene	0<W	0<W	0<W	0<W
Indeno(1,2,3-C,D)Pyrene	0<W	0<W	0<W	0<W
Benzo(B)Chrysene	0<W	0<W	0<W	0<W

Trace Metals (mg/l)

Iron	0.41	0.3	<0.29	0.28	0.21	0.21	0.29
Manganese	0.03	0.02	0.01	0.02	0.01	<0.10	0.02
Aluminum	0.27	0.11	0.11	0.15	<0.10	<1.0	0.13
Beryllium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01
Cadmium	0.003	<0.001	<0.001	<0.001	<0.001	<0.01	<0.001
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	<0.01
Chromium	2.1	1.9	0.55	0.62	0.46	<0.10	0.33
Copper	0.02	<0.01	<0.01	<0.01	<0.01	<0.10	0.04
Mercury (ug/l)	0.04	0.11		0.03	0.04	0.01	0.03
Nickel	0.02	<0.01	<0.01	<0.01	<0.01	<0.10	<0.01
Lead	0.02	<0.01	<0.01	<0.01	0.01	<0.10	<0.01
Strontium	0.03	0.03	0.03	0.03	0.03	<0.05	0.06
Vanadium	0.02	<0.01	<0.01	<0.01	<0.01	<0.10	<0.01
Zinc	<0.01	<0.01	<0.01	<0.01	<0.01	<0.10	0.01

Sample	1A	1B	2A	2B	3A	3B
Date	860809	860809	860810	860810	860811	860811
Time	14:05	20:05	12:05	20:05	12:05	16:07
Volatiles (ug/l)						
11 Dichloroethylene	SM!	SM!	1<W	1<W	1<W	1<W
Dichloromethane	SM!	SM!	1<W	1<W	2<T	2<T
12 Dichloroethylene	SM!	SM!	1<W	1<W	1<W	1<W
11 Dichloroethane	SM!	SM!	1<W	1<W	1<W	1<W
Chloroform	SM!	SM!	595	624	1226	1314
111 Trichloroethane	SM!	SM!	1<W	1<W	1<W	1<W
12 Dichloroethane	SM!	SM!	1<W	1<W	1<W	1<W
Carbontetrachloride	SM!	SM!	1<W	1<W	2<T	1<W
Benzene	SM!	SM!	1<W	1<W	1<W	1<W
Trichloroethylene	SM!	SM!	1<W	1<W	1<W	1<W
Dichlorobromomethane	SM!	SM!	14	11	12	11
Toluene	SM!	SM!	1<W	1<W	1<W	1<W
112 Trichloroethane	SM!	SM!	1<W	1<W	1<W	1<W
Chlorodibromomethane	SM!	SM!	1<W	1<W	1<W	1<W
Tetrachloroethylene	SM!	SM!	1<W	1<W	1<W	1<W
Chlorobenzene	SM!	SM!	1<W	1<W	1<W	1<W
Trifluorochlorotoluene	SM!	SM!				
Ethylbenzene	SM!	SM!	1<W	1<W	1<W	1<W
Ethylene Dibromide	SM!	SM!				
M & P Xylenes	SM!	SM!	1<W	1<W	1<W	1<W
Bromoform	SM!	SM!	1<W	1<W	1<W	1<W
O-xylene	SM!	SM!	1<W	1<W	1<W	1<W
1122 Tetrachloroethane	SM!	SM!	1<W	1<W	1<W	1<W
14 Dichlorobenzene	SM!	SM!	1<W	1<W	1<W	1<W
13 Dichlorobenzene	SM!	SM!	1<W	1<W	1<W	1<W
12 Dichlorobenzene	SM!	SM!	1<W	1<W	1<W	1<W

Sample	5A	5B	6A	6B	7A	7B
Date	860813	860814	860814	860814	860815	860815
Time	20:05	04:05	12:05	20:05	12:05	20:05
Volatiles (ug/l)						
11 Dichloroethylene	10<W	LA!	1<W	1<W	SM!	1<W
Dichloromethane	14<T	LA!	2<T	4<T	SM!	3<T
12 Dichloroethylene	10<W	LA!	1<W	1<W	SM!	1<W
11 Dichloroethane	10<W	LA!	1<W	1<W	SM!	1<W
Chloroform	10<W	LA!	627	344	SM!	380
111 Trichloroethane	10<W	LA!	1<W	1<W	SM!	1<W
12 Dichloroethane	10<W	LA!	1<W	1<W	SM!	1<W
Carbontetrachloride	10<W	LA!	1<W	1<W	SM!	1<W
Benzene	10<W	LA!	1<W	1<W	SM!	1<W
Trichloroethylene	10<W	LA!	1<W	1<W	SM!	1<W
Dichlorobromomethane	10<W	LA!	14	7<T	SM!	8<T
Toluene	10<W	LA!	1<W	1<W	SM!	1<W
112 Trichloroethane	10<W	LA!	1<W	1<W	SM!	1<W
Chlorodibromomethane	10<W	LA!	1<T	1<W	SM!	1<W
Tetrachloroethylene	10<W	LA!	1<W	1<W	SM!	1<W
Chlorobenzene	10<W	LA!	1<W	1<W	SM!	1<W
Trifluorochlorotoluene	10<W	LA!	1<W	1<W	SM!	1<W
Ethylbenzene	10<W	LA!	1<W	1<W	SM!	1<W
Ethylene Dibromide	10<W	LA!	1<W	1<W	SM!	1<W
M & P Xylenes	10<W	LA!	1<W	1<W	SM!	1<W
Bromoform	10<W	LA!	2<T	1<W	SM!	1<W
O-xylene	10<W	LA!	1<W	1<W	SM!	1<W
1122 Tetrachloroethane	10<W	LA!	1<W	1<W	SM!	1<W
14 Dichlorobenzene	10<W	LA!	1<W	1<W	SM!	1<W
13 Dichlorobenzene	10<W	LA!	1<W	1<W	SM!	1<W
12 Dichlorobenzene	10<W	LA!	1<W	1<W	SM!	1<W

CANADIAN PACIFIC FOREST PRODUCTS

GRAB SAMPLES - B OUTFALL

Sample Number	7	8	9	10	11	12	13
Date	860812	860812	860812	860813	860813	860813	860813
Time	12:10	16:10	20:00	00:22	04:10	08:20	12:20
Chlorinated Phenols (ng/l)							
246 Trichlorophenol	200	380	130	260	120	380	500
245 Trichlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W	100<W	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
Pentachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
Fatty Acids (ug/l)							
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	12	12	10<W	10<W	10<W	10<W	10<W
Stearic	21	31	75	16	25	11	10<W
Oleic/Linoleic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Aromatic Acids (ug/l)							
Benzoic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Resin Acids (ug/l)							
Pimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	10<W	32	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Speciated Phenolics (ug/l)							
Phenol	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Vanillin	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Homovanillic Acid	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Guaicol	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Syringaldehyde	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Acetovanillone	LA!	LA!	IS!	LA!	SM!	SM!	1<W
Acetosyringone	LA!	LA!	IS!	LA!	SM!	SM!	1<W

Volatiles (ug/l)

11 Dichloroethylene	1<E	1<E	1<E	1<E	1<E	10<E	2<T
Dichloromethane	1<E	1<E	1<E	1<E	9<T	72<T	2<T
12 Dichloroethylene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
11 Dichloroethane	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Chloroform	787	886	543	1<E	422	65<T	486
111 Trichloroethane	1<E	1<E	1<E	1<E	1<E	10<E	1<E
12 Dichloroethane	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Carbontetrachloride	1<T	1<E	1<E	1<E	1<E	10<E	1<E
Benzene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Trichloroethylene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Dichlorobromomethane	8	8	10	1<E	9<T	10<E	11
Toluene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
112 Trichloroethane	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Chlorodibromomethane	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Tetrachloroethylene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Chlorobenzene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Trifluorochlorotoluene					1<E	10<E	1<E
Ethylbenzene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Ethylene Dibromide					1<E	10<E	1<E
M & P Xylenes	1<E	1<E	1<E	1<E	1<E	10<E	1<E
Bromoform	1<E	1<E	1<E	1<E	1<E	10<E	1<E
O-xylene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
1122 Tetrachloroethane	1<E	1<E	1<E	1<E	1<E	10<E	1<E
14 Dichlorobenzene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
13 Dichlorobenzene	1<E	1<E	1<E	1<E	1<E	10<E	1<E
12 Dichlorobenzene	1<E	1<E	1<E	1<E	1<E	10<E	1<E

Trace Metals (mg/l)

Iron	0.34	0.33	0.33	0.29	0.37	0.3	0.35
Manganese	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Aluminum	0.15	0.16	0.18	0.19	0.2	0.17	0.18
Beryllium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	0.62	0.88	0.7	0.63	0.56	0.44	0.64
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury (ug/l)	0.03	0.06	0.07	0.03	0.04	0.04	0.04
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	0.03	0.03	0.04	0.03	0.03	0.09	0.03
Vanadium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

REICHHOLD CHEMICAL

Sample Number	1	2	3	4	5	6	7
Date	860809	860810	860811	860812	860813	860814	860815
Time	12:00	12:00	12:00	12:00	12:00	12:00	12:00
Organochlorine (ng/l)							
PCB	20<W	20<W	20<W	20<W	20<W	20<W	20<W
Hexachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Heptachlor	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Aldrin	1<W	1<W	1<W	1<W	1<W	1<W	1<W
pp-DDE	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Mirex	5<W	5<W	5<W	5<W	5<W	5<W	5<W
a-BHC	1<W	1<W	1<W	1<W	1<W	1<W	1<W
b-BHC	1<W	1<W	1<W	1<W	1<W	1<W	1<W
g-BHC	1<W	1<W	1<W	1<W	1<W	1<W	1<W
a-chlordane	2<W	2<W	2<W	2<W	2<W	2<W	2<W
g-chlordane	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Oxychlordane	2<W	2<W	2<W	2<W	2<W	2<W	2<W
op-DDT	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDD	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDT	5<W	5<W	5<W	5<W	5<W	5<W	5<W
DMDT Methoxychlor	5<W	5<W	5<W	5<W	5<W	5<W	5<W
Heptachlorepoxide	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Endosulfan I	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endosulfan II	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Dieldrin	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endrin	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Endosulfan Sulphate	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Octachlorostyrene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Chlorobenzene (ng/l)							
Hexachloroethane	1<W	1<W	1<W	1<W	1<W	1<W	1<W
135 Trichlorobenzene	2<W	2<W	2<W	2<W	2<W	2<W	2<W
124 Trichlorobenzene	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Hexachlorobutadiene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
123 Trichlorobenzene	2<W	2<W	2<W	2<W	2<W	2<W	2<W
245 Trichlorotoluene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
236 Trichlorotoluene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1235 Tetrachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1245 Tetrachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
26a Trichlorotoluene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1234 Tetrachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Pentachlorobenzene	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Chlorinated Phenols (ng/l)							
246 Trichlorophenol	50<W	50<W	50<W	8900	7400	300	15000
245 Trichlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W	100<W	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W	50<W	50<W	50<W
Pentachlorophenol	50<W	50<W	50<W	20000	50<W	50<W	50<W
Phenoxy Acids (ng/l)							
Dicamba	100<W	100<W	100<W	100<W	100<W	100<W	100<W
24D Propionic Acid	690	100<W	300	100<W	100<W	100<W	100<W
24 Dichlorophenoxyacetic	390	200	320	100<W	100<W	100<W	100<W
Silvex	50<W	50<W	50<W	50<W	50<W	50<W	50<W
245 Trichlorophenoxyacetic	50<W	100	640	50<W	50<W	50<W	50<W
24 Dichlorophenoxybutyrc	200<W	200<W	200<W	200<W	200<W	200<W	200<W
Picloram	100<W	100<W	100<W	100<W	100<W	100<W	100<W
Fatty Acids (ug/l)							
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	11	10<W	12	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	14	18	19	26	34	10<W	10<W
Stearic	16	17	31	35	36	10<W	10<W
Oleic/Linoleic	250	260	222	247	323	10<W	700
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Aromatic Acids (ug/l)

Benzoic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Speciated Phenolics (ug/l)

Phenol	LA!	LA!	IS!	IS!	LA!	1<W	1<W
Vanillin	LA!	LA!	IS!	IS!	LA!	1<W	1<W
Homovanillic Acid	LA!	LA!	IS!	IS!	LA!	1<W	2<T
Guaicol	LA!	LA!	IS!	IS!	LA!	1<W	1<W
Syringaldehyde	LA!	LA!	IS!	IS!	LA!	1<W	1<W
Acetovanillone	LA!	LA!	IS!	IS!	LA!	1<W	3<T
Acetosyringone	LA!	LA!	IS!	IS!	LA!	1<W	1<W

Polynuclear Aromatic Hydrocarbons (ng/l)

Phenanthrene	0<W	0<W	60-300	0<W
Anthracene	0<W	0<W	0<W	0<W
Fluoranthene	0<W	0<W	20-100	0<W
Pyrene	0<W	0<W	10-50	0<W
Benz(A)Anthracene	0<W	0<W	0<W	0<W
Chrysene	0<W	0<W	0<W	0<W
Dimeth.Benz(A)Anthracene	0<W	0<W	0<W	0<W
Benzo(E) Pyrene	0<W	0<W	0<W	0<W
Benzo(J)Fluoranthene	0<W	0<W	0<W	0<W
Benzo(B)Fluoranthene	0<W	0<W	0<W	0<W
Perylene	0<W	0<W	0<W	0<W
Benzo(K)Fluoranthene	0<W	0<W	0<W	0<W
Benzo(A) Pyrene	0<W	0<W	0<W	0<W
Benzo(G,H,I)Perylene	0<W	0<W	0<W	0<W
Indeno(1,2,3-C,D)Pyrene	0<W	0<W	0<W	0<W
Benzo(B)Chrysene	0<W	0<W	10-50	0<W

Trace Metals (mg/l)

Iron	0.22	0.18	0.28	0.18	0.28	0.31	0.18
Manganese	<0.10	<0.10	<0.10	<0.10	<0.10	0.02	<0.10
Aluminum	<1.0	<1.0	<1.0	<1.0	<1.0	0.15	<1.0
Beryllium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.01	<0.5
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01
Cobalt	<0.10	<0.10	<0.10	<0.10	<0.10	<0.01	<0.10
Chromium	<0.10	<0.10	<0.10	<0.10	<0.10	0.61	<0.10
Copper	<0.10	<0.10	<0.10	<0.10	<0.10	<0.01	<0.10
Mercury (ug/l)	0.01	0.01	0.01	0.01	0.02	0.04	
Nickel	<0.10	<0.10	<0.10	<0.10	<0.10	<0.01	<0.10
Lead	<0.10	<0.10	<0.10	<0.10	<0.10	<0.01	<0.10
Strontium	<0.05	<0.05	<0.05	<0.05	0.05	0.03	<0.05
Vanadium	<0.10	<0.10	<0.10	<0.10	<0.10	<0.01	<0.10
Zinc	<0.10	<0.10	<0.10	<0.10	<0.10	<0.01	<0.10

Sample	1A	1B	2A	2B	3A	3B	4A
Date	860809	860809	860810	860810	860811	860812	860812
Time	14:00	20:00	12:00	20:00	12:10	04:25	12:15
Volatiles (ug/l)							
11 Dichloroethylene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Dichloromethane	SMI	SMI	10<W	SMI	50	50	80<T
12 Dichloroethylene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
11 Dichloroethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Chloroform	SMI	SMI	10<W	SMI	10<W	10<W	10<W
111 Trichloroethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
12 Dichloroethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Carbontetrachloride	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Benzene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Trichloroethylene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Dichlorobromomethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Toluene	SMI	SMI	19<T	SMI	10<W	10<W	10<W
112 Trichloroethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Chlorodibromomethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Tetrachloroethylene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Chlorobenzene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Trifluorochlorotoluene	SMI	SMI		SMI			10<W
Ethylbenzene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Ethylene Dibromide	SMI	SMI		SMI			10<W
M & P Xylenes	SMI	SMI	10<W	SMI	10<W	10<W	10<W
Bromoform	SMI	SMI	10<W	SMI	10<W	10<W	10<W
O-xylene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
1122 Tetrachloroethane	SMI	SMI	10<W	SMI	10<W	10<W	10<W
14 Dichlorobenzene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
13 Dichlorobenzene	SMI	SMI	10<W	SMI	10<W	10<W	10<W
12 Dichlorobenzene	SMI	SMI	10<W	SMI	10<W	10<W	10<W

Sample	4B	5A	5B	6A	6B	7A	7B
Date	860813	860813	860814	860814	860814	860815	860815
Time	04:20	20:20	04:16	12:20	20:20	12:20	20:20
Volatiles (ug/l)							
11 Dichloroethylene	10<T	10<W	10<W	10<W	1<W	SMI	1<W
Dichloromethane	80<T	30<T	50<T	60<T	1<W	SMI	25<T
12 Dichloroethylene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
11 Dichloroethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Chloroform	10<W	10<W	110	10<W	1<W	SMI	1<W
111 Trichloroethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
12 Dichloroethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Carbontetrachloride	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Benzene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Trichloroethylene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Dichlorobromomethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Toluene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
112 Trichloroethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Chlorodibromomethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Tetrachloroethylene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Chlorobenzene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Trifluorochlorotoluene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Ethylbenzene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Ethylene Dibromide	10<W	10<W	10<W	10<W	1<W	SMI	1<W
M & P Xylenes	10<W	10<W	10<W	10<W	1<W	SMI	1<W
Bromoform	10<W	10<W	10<W	10<W	1<W	SMI	1<W
O-xylene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
1122 Tetrachloroethane	10<W	10<W	10<W	10<W	1<W	SMI	1<W
14 Dichlorobenzene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
13 Dichlorobenzene	10<W	10<W	10<W	10<W	1<W	SMI	1<W
12 Dichlorobenzene	10<W	10<W	10<W	10<W	1<W	SMI	1<W

OGILVIE MILLS

Sample Number	1	2	3
Date	860811	860812	860813
Time	12:00	12:00	12:00
Organochlorine (ng/l)			
PCB	20<W	20<W	20<W
Hexachlorobenzene	1<W	1<W	1<W
Heptachlor	12	1<W	42
Aldrin	1<W	1<W	1<W
pp-DDE	1<W	1<W	120
Mirex	5<W	5<W	5<W
a-BHC	1<W	1<W	1<W
b-BHC	1<W	1<W	1<W
g-BHC	1<W	1<W	1<W
a-chlordane	2<W	2<W	2<W
g-chlordane	2<W	2<W	29
Oxychlordane	2<W	2<W	2<W
op-DDT	5<W	5<W	5<W
pp-DDD	5<W	5<W	25
pp-DDT	5<W	5<W	5<W
DMDT Methoxychlor	5<W	5<W	5<W
Heptachlorepoxide	1<W	1<W	1<W
Endosulfan I	2<W	2<W	2<W
Endosulfan II	4<W	4<W	58
Dieldrin	4	2<W	46
Endrin	4<W	4<W	22
Endosulfan Sulphate	4<W	4<W	4<W
Octachlorostyrene	1<W	1<W	1<W
Chlorobenzene (ng/l)			
Hexachloroethane	1<W	1<W	1<W
135 Trichlorobenzene	2<W	2<W	2<W
124 Trichlorobenzene	2<W	2<W	2<W
Hexachlorobutadiene	1<W	1<W	1<W
123 Trichlorobenzene	2<W	2<W	2<W
245 Trichlorotoluene	1<W	1<W	1<W
236 Trichlorotoluene	1<W	1<W	1<W
1235 Tetrachlorobenzene	1<W	1<W	1<W
1245 Tetrachlorobenzene	1<W	1<W	1<W
26a Trichlorotoluene	1<W	1<W	1<W
1234 Tetrachlorobenzene	1<W	1<W	1<W
Pentachlorobenzene	1<W	1<W	1<W
Chlorinated Phenols (ng/l)			
246 Trichlorophenol	50<W	320	50<W
245 Trichlorophenol	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W
Pentachlorophenol	50<W	50<W	80
Phenoxy Acids (ng/l)			
Dicamba	100<W	100<W	100<W
24D Propionic Acid	100<W	100<W	100<W
24 Dichlorophenoxyacetic	100<W	100<W	100<W
Silvex	50<W	50<W	50<W
245 Trichlorophenoxyacetic	50<W	50<W	50<W
24 Dichlorophenoxybutyrc	200<W	200<W	200<W
Picloram	100<W	100<W	100<W
Fatty Acids (ug/l)			
Capric	10<W	10<W	10<W
Lauric	250	10<W	32
Myristic	460	10<W	189
Palmitic	2880	10<W	2548
Stearic	340	10<W	150
Oleic/Linoleic	10<W	10<W	904
Arachidic	40	10<W	18

Aromatic Acids (ug/l)

Benzoic	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	10<W	392
Sandaracopimaric	10<W	10<W	370
Levopimaric/Palustric	10<W	10<W	10<W
Isopimaric	45	10<W	898
Neoabietic	10<W	10<W	10<W
Abietic	10<W	10<W	10<W
Dehydroabietic	10<W	10<W	28

Speciated Phenolics (ug/l)

Phenol	IS!	IS!	LA!
Vanillin	IS!	IS!	LA!
Homovanillic Acid	IS!	IS!	LA!
Guaicol	IS!	IS!	LA!
Syringaldehyde	IS!	IS!	LA!
Acetovanillone	IS!	IS!	LA!
Acetosyringone	IS!	IS!	LA!

Polynuclear Aromatic Hydrocarbons (ng/l)

Phenanthrene	0<W	0<W
Anthracene	0<W	0<W
Fluoranthene	0<W	0<W
Pyrene	0<W	0<W
Benz(A)Anthracene	0<W	0<W
Chrysene	0<W	0<W
Dimeth.Benz(A)Anthracene	0<W	0<W
Benzo(E) Pyrene	0<W	0<W
Benzo(J)Fluoranthene	0<W	0<W
Benzo(B)Fluoranthene	0<W	0<W
Perylene	0<W	0<W
Benzo(K)Fluoranthene	0<W	0<W
Benzo(A) Pyrene	0<W	0<W
Benzo(G,H,I)Perylene	0<W	0<W
Indeno(1,2,3-C,D)Pyrene	0<W	0<W
Benzo(B)Chrysene	0<W	0<W

Trace Metals (mg/l)

Iron	2.0	1.5	4.1
Manganese	0.33	0.47	0.71
Aluminum	<1.0	<1.0	<1.0
Beryllium	<0.05	<0.05	<0.05
Cadmium	<0.01	<0.01	<0.01
Cobalt	<0.10	<0.10	<0.10
Chromium	<0.10	<0.10	<0.10
Copper	<0.10	0.15	0.34
Mercury (ug/l)	0.04	0.03	0.11
Nickel	<0.10	<0.10	<0.10
Lead	<0.10	<0.10	<0.10
Strontium	0.08	0.08	0.08
Vanadium	<0.10	<0.10	<0.10
Zinc	0.36	0.49	1.1

Sample	1A	1B	2A	2B	3A	3B
Date	860811	860812	860812	860813	860813	860814
Time	12:15	04:42	13:00	04:40	20:40	04:32
Volatiles (ug/l)						
11 Dichloroethylene	20<W	20<W	10<W	10<W	1<W	1<W
Dichloromethane	80<T	60<T	81<T	81<T	1<W	1<W
12 Dichloroethylene	20<W	20<W	10<W	10<W	1<W	1<W
11 Dichloroethane	20<W	20<W	10<W	10<W	1<W	1<W
Chloroform	20<W	20<W	!0<W	10<W	175	1<W
111 Trichloroethane	20<W	20<W	10<W	10<W	1<W	1<W
12 Dichloroethane	20<W	20<W	10<W	10<W	1<W	1<W
Carbontetrachloride	20<W	20<W	10<W	10<W	1<W	1<W
Benzene	20<W	20<W	10<W	10<W	1<W	1<W
Trichloroethylene	20<W	20<W	10<W	10<W	1<W	1<W
Dichlorobromomethane	20<W	20<W	10<W	10<W	6<T	1<W
Toluene	20<W	20<W	10<W	10<W	1<W	1<W
112 Trichloroethane	20<W	20<W	10<W	10<W	1<W	1<W
Chlorodibromomethane	20<W	20<W	10<W	10<W	1<W	1<W
Tetrachloroethylene	20<W	20<W	10<W	10<W	1<W	1<W
Chlorobenzene	20<W	20<W	10<W	10<W	1<W	1<W
Trifluorochlorotoluene			10<W	10<W	1<W	1<W
Ethylbenzene	20<W	20<W	10<W	10<W	1<W	1<W
Ethylene Dibromide			10<W	10<W	1<W	1<W
M & P Xylenes	20<W	20<W	10<W	10<W	1<W	1<W
Bromoform	20<W	20<W	10<W	10<W	1<W	1<W
O-xylene	20<W	20<W	10<W	10<W	1<W	1<W
1122 Tetrachloroethane	20<W	20<W	10<W	10<W	1<W	1<W
14 Dichlorobenzene	20<W	20<W	10<W	10<W	1<W	1<W
13 Dichlorobenzene	20<W	20<W	10<W	10<W	1<W	1<W
12 Dichlorobenzene	20<W	20<W	10<W	10<W	1<W	1<W

THUNDER BAY SEWAGE TREATMENT PLANT

Sample Number	1	2	3
Date	860811	860812	860813
Time	12:00	12:00	12:00
Organochlorine (ng/l)			
PCB	20<W	20<W	20<W
Hexachlorobenzene	1<W	1<W	1<W
Heptachlor	1<W	1<W	1<W
Aldrin	1<W	1<W	1<W
pp-DDE	1<W	1<W	1<W
Mirex	5<W	5<W	5<W
a-BHC	1<W	1<W	1<W
b-BHC	1<W	1<W	1<W
g-BHC	1<W	1<W	250
a-chlordane	2<W	2<W	2<W
g-chlordane	2<W	2<W	2<W
Oxychlordane	2<W	2<W	10
op-DDT	5<W	5<W	5<W
pp-DDD	5<W	5<W	5<W
pp-DDT	5<W	5<W	5<W
DMDT Methoxychlor	5<W	5<W	5<W
Heptachlorepoxide	1<W	1<W	1<W
Endosulfan I	2<W	2<W	2<W
Endosulfan II	4<W	4<W	4<W
Dieldrin	2<W	2<W	2<W
Endrin	4<W	4<W	4<W
Endosulfan Sulphate	4<W	4<W	4<W
Octachlorostyrene	1<W	1<W	1<W
Chlorobenzene (ng/l)			
Hexachloroethane	1<W	1<W	1<W
135 Trichlorobenzene	2<W	2<W	2<W
124 Trichlorobenzene	2<W	2<W	2<W
Hexachlorobutadiene	1<W	1<W	1<W
123 Trichlorobenzene	2<W	2<W	2<W
245 Trichlorotoluene	1<W	1<W	1<W
236 Trichlorotoluene	1<W	1<W	1<W
1235 Tetrachlorobenzene	1<W	1<W	1<W
1245 Tetrachlorobenzene	1<W	1<W	1<W
26a Trichlorotoluene	1<W	1<W	1<W
1234 Tetrachlorobenzene	1<W	1<W	1<W
Pentachlorobenzene	1<W	1<W	1<W
Chlorinated Phenols (ng/l)			
246 Trichlorophenol	50<W	340	130
245 Trichlorophenol	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	50<W	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W
Pentachlorophenol	250	130	410
Phenoxy Acids (ng/l)			
Dicamba	100<W	100<W	100<W
24D Propionic Acid	100<W	100<W	100<W
24 Dichlorophenoxyacetic	100<W	100<W	100<W
Silvex	50<W	50<W	50<W
245 Trichlorophenoxyacetic	50<W	50<W	50<W
24 Dichlorophenoxybutyrc	200<W	200<W	200<W
Picloram	100<W	100<W	100<W
Fatty Acids (ug/l)			
Capric	10<W	10<W	10<W
Lauric	10<W	10<W	10<W
Myristic	10<W	13	25
Palmitic	84	141	10<W
Stearic	10<W	144	10<W
Oleic/Linoleic	270	112	10<W
Arachidic	10<W	10<W	14

Aromatic Acids (ug/l)

Benzoic	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	75	10<W	10<W
Sandaracopimaric	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W
Isopimaric	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W
Abietic	10<W	10<W	10<W
Dehydroabietic	10<W	10<W	10<W

Speciated Phenolics (ug/l)

Phenol		ISI	LAI
Vanillin		ISI	LAI
Homovanillic Acid		ISI	LAI
Guaicol		ISI	LAI
Syringaldehyde		ISI	LAI
Acetovanillone		ISI	LAI
Acetosyringone		ISI	LAI

Polynuclear Aromatic Hydrocarbons (ng/l)

Phenanthrene	0<W	0<W
Anthracene	0<W	0<W
Fluoranthene	4-20	0<W
Pyrene	20-100	0<W
Benz(A)Anthracene	0<W	0<W
Chrysene	0<W	0<W
Dimeth.Benz(A)Anthracene	0<W	0<W
Benzo(E) Pyrene	0<W	0<W
Benzo(J)Fluoranthene	0<W	0<W
Benzo(B)Fluoranthene	4-20	0<W
Perylene	0<W	0<W
Benzo(K)Fluoranthene	2-10	0<W
Benzo(A) Pyrene	4-20	0<W
Benzo(G,H,I)Perylene	0<W	0<W
Indeno(1,2,3-C,D)Pyrene	0<W	0<W
Benzo(B)Chrysene	0<W	0<W

Trace Metals (mg/l)

Iron	9.6	7.1	9.5
Manganese	0.33	0.35	0.32
Aluminum	<0.10	<1.0	0.16
Beryllium	<0.01	<0.05	<0.01
Cadmium	<0.001	<0.01	<0.001
Cobalt	<0.01	<0.10	<0.01
Chromium	0.01	<0.10	0.02
Copper	0.03	<0.10	0.03
Mercury (ug/l)		0.05	0.11
Nickel	<0.01	<0.10	<0.01
Lead	0.01	<0.10	0.01
Strontium	0.08	0.08	0.08
Vanadium	<0.01	<0.10	<0.01
Zinc	0.03	<0.10	0.03

Sample	1A	1B	2A	2B	3A	3B
Date	860811	860812	860812	860813	860813	860814
Time	12:20	05:07	13:15	05:05	21:00	04:52
Volatiles (ug/l)						
11 Dichloroethylene	10<W	10<W	10<W	1<W	1<W	SMI
Dichloromethane	40<T	40<T	63<T	20	1<W	SMI
12 Dichloroethylene	10<W	10<W	10<W	1<W	1<W	SMI
11 Dichloroethane	10<W	10<W	10<W	1<W	1<W	SMI
Chloroform	10<W	10<W	10<W	5<T	1<W	SMI
111 Trichloroethane	10<W	10<W	10<W	1<W	1<W	SMI
12 Dichloroethane	10<W	10<W	10<W	1<W	1<W	SMI
Carbontetrachloride	10<W	10<W	10<W	1<W	1<W	SMI
Benzene	10<W	10<W	10<W	1<W	1<W	SMI
Trichloroethylene	10<W	10<W	10<W	1<W	1<W	SMI
Dichlorobromomethane	10<W	10<W	10<W	1<W	1<W	SMI
Toluene	10<W	16	10<W	1<W	1<W	SMI
112 Trichloroethane	10<W	10<W	10<W	1<W	1<W	SMI
Chlorodibromomethane	10<W	10<W	10<W	1<W	1<W	SMI
Tetrachloroethylene	10	10<W	10<W	1<W	1<W	SMI
Chlorobenzene	10<W	10<W	10<W	1<W	1<W	SMI
Trifluorochlorotoluene			10<W	1<W	1<W	SMI
Ethylbenzene	10<W	10<W	10<W	1<W	1<W	SMI
Ethylene Dibromide			10<W	1<W	1<W	SMI
M & P Xylenes	10<W	10<W	14<T	1<W	1<W	SMI
Bromoform	10<W	10<W	10<W	1<W	1<W	SMI
O-xylene	10<W	10<W	10<T	1<W	1<W	SMI
1122 Tetrachloroethane	10<W	10<W	10<W	1<W	1<W	SMI
14 Dichlorobenzene	10<W	10<W	10<W	1<W	1<W	SMI
13 Dichlorobenzene	10<W	10<W	10<W	1<W	1<W	SMI
12 Dichlorobenzene	10<W	10<W	10<W	1<W	1<W	SMI

APPENDIX C:
RECEIVING WATER SAMPLING RESULTS

NOTE: 1) Results presented across all sampling stations by sampling run.

2) Remark codes are described in Section 3.1, Table 3.1.

Run	7											
Station	A	B	D	G	H	I	J	K	L	M	O	P
Date	860812	860812	860812	860812	860812	860812	860812	860812	860812	860812	860812	860812
Time	12:05	12:22	12:40	13:05	13:15	13:25	11:55	12:10	12:20	12:30	12:50	13:07
Organochlorine (ng/l)												
PCB	20<W	ROI	ROI	ROI	20<W	20<W	20<W	20<W	20<W	20<W	20<W	20<W
Hexachlorobenzene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Heptachlor	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Aldrin	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
pp-DDE	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Mirex	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
a-BHC	2<T	ROI	ROI	ROI	3<T	3<T	3<T	3<T	3<T	4<T	3<T	4<T
b-BHC	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
g-BHC	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<T
a-chlordane	2<W	ROI	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W	2<W
g-chlordane	2<W	ROI	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Oxychlordane	2<W	ROI	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W	2<W
op-DDT	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDD	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDT	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
DMDT Methoxychlor	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
Heptachlorepoxide	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Endosulfan I	2<W	ROI	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endosulfan II	4<W	ROI	ROI	ROI	4<W	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Dieldrin	2<W	ROI	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endrin	4<W	ROI	ROI	ROI	4<W	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Endosulfan Sulphate	4<W	ROI	ROI	ROI	4<W	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Octachlorostyrene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Chlorobenzene (ng/l)												
Hexachloroethane	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
135 Trichlorobenzene	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
124 Trichlorobenzene	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
Hexachlorobutadiene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
123 Trichlorobenzene	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
245 Trichlorotoluene	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
236 Trichlorotoluene	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
1235 Tetrachlorobenzene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1245 Tetrachlorobenzene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
26a Trichlorotoluene	5<W	ROI	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W	5<W
1234 Tetrachlorobenzene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Pentachlorobenzene	1<W	ROI	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W

Chlorinated Phenols (ng/l)

246 Trichlorophenol	50<W	430<T	LAI	50<W
245 Trichlorophenol	50<W	50<W	LAI	50<W
234 Trichlorophenol	100<W	100<W	LAI	100<W
2356 Tetrachlorophenol	50<W	60<T	LAI	50<W
2345 Tetrachlorophenol	50<W	50<W	LAI	50<W
Pentachlorophenol	50<W	CSI	LAI	50<W

Phenoxy Acids (ng/l)

Dicamba	100<W	ROI	ROI	ROI
24D Propionic Acid	100<W	ROI	ROI	380<T
24 Dichlorophenoxyacetic	100<W	ROI	ROI	ROI
Silvex	50<W	ROI	ROI	ROI
245 Trichlorophenoxyacetic	50<W	ROI	ROI	ROI
24 Dichlorophenoxybutyric	200<W	ROI	ROI	ROI

Fatty Acids (ug/l)

Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Stearic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Aromatic Acids (ug/l)

Benzoic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	12	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	13	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	29	12	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	47	18	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	88	29	15	16	10<W	15	16	11	10<W	10<W	10<W

Speciated Phenolics (ug/l)

Phenol	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI
Vanillin	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI
Homovanillic Acid	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI
Guaicol	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI
Syringaldehyde	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI
Acetovanillone	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI
Acetosyringone	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI

Volatiles (ug/l)

11 Dichloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Dichloromethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
12 Dichloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
11 Dichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Chloroform	0<W	244	154	94	98	82	93	96	80	24	68	60
111 Trichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
12 Dichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Carbontetrachloride	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Benzene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	2 UCR	0<W	0<W	0<W
Trichloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Dichlorobromomethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Toluene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
112 Trichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Chlorodibromomethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Tetrachloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Chlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Trifluorochlorotoluene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Ethylbenzene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
Ethylene Dibromide	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
M & P Xylenes	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	3	0<W	0<W	0<W
Bromoform	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
O-xylene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	3	0<W	0<W	0<W
1122 Tetrachloroethane	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
14 Dichlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
13 Dichlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W
12 Dichlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	0<W	0<W

Trace Metals (mg/l)

Iron	0.4	0.48	0.57	0.45	0.53	0.37	0.49	0.42	0.39	0.3	0.4	0.44
Manganese	0.014	0.110	0.098	0.070	0.074	0.043	0.068	0.063	0.056	0.029	0.057	0.056
Aluminum	0.11	0.40	0.44	0.32	0.40	0.22	0.31	0.29	0.25	0.14	0.25	0.24
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	0.010	0.041	0.035	0.033	0.023	0.033	0.030	0.024	0.008	0.026	0.022
Copper	0.002	0.004	0.004	0.003	0.003	0.002	0.003	0.003	0.003	0.002	0.003	0.002
Mercury (ug/l)	<0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.002	0.002	0.003	<0.002	0.004	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Strontium	0.024	0.038	0.033	0.030	0.032	0.028	0.031	0.029	0.030	0.028	0.029	0.029
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.003	0.015	0.012	0.007	0.009	0.006	0.008	0.007	0.007	0.004	0.007	0.008

	Run	9											
	Station	A	B	D	G	H	I	J	K	L	M	O	P
	Date	860812	860812	860812	860812	860812	860812	860812	860812	860812	860812	860812	860812
	Time	20:03	20:20	20:30	20:45	20:45	20:55	19:55	20:10	20:20	20:25	20:40	20:50
Chlorinated Phenols (ng/l)													
246 Trichlorophenol		50<W	940	50<W	50<W								
245 Trichlorophenol		50<W	50<W	50<W	50<W								
234 Trichlorophenol		100<W	100<W	100<W	100<W								
2356 Tetrachlorophenol		50<W	50<T	50<W	50<W								
2345 Tetrachlorophenol		50<W	50<W	50<W	50<W								
Pentachlorophenol		50<W	50<T	50<W	50<W								
Phenoxy Acids (ng/l)													
Dicamba		100<W	ROI	ROI	ROI								
24D Propionic Acid		100<W	ROI	ROI	ROI								
24 Dichlorophenoxyacetic		100<W	ROI	ROI	ROI								
Silvex		50<W	ROI	ROI	ROI								
245 Trichlorophenoxyacetic		50<W	ROI	ROI	ROI								
24 Dichlorophenoxybutyrc		200<W	ROI	ROI	ROI								
Fatty Acids (ug/l)													
Capric		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Stearic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic		10<W	10<W	10<W	12	11	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Arachidic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Aromatic Acids (ug/l)													
Benzoic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic		10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)												
Pimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	10<W	21	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	53	74	15	11	10<W	9	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	27	43	19	14	10<W	14	10<W	10<W	10<W	10<W	10<W
Speciated Phenolics (ug/l)												
Phenol	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Vanillin	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Homovanillic Acid	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Guaicol	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Syringaldehyde	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Acetovanillone	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Acetosyringone	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI	ISI
Volatiles (ug/l)												
11 Dichloroethylene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Dichloromethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
12 Dichloroethylene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
11 Dichloroethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Chloroform	0<W	213	202	113	92	33	89	99	69	37	56	54
111 Trichloroethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
12 Dichloroethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Carbontetrachloride	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Benzene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Trichloroethylene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Dichlorobromomethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Toluene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
112 Trichloroethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Chlorodibromomethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Tetrachloroethylene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Chlorobenzene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Trifluorochlorotoluene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Ethylbenzene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Ethylene Dibromide	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
M & P Xylenes	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
Bromoform	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
O-xylene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
1122 Tetrachloroethane	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
14 Dichlorobenzene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
13 Dichlorobenzene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W
12 Dichlorobenzene	0<W	SPSI	SPSI	APSI	0<W	0<W	0<W	0<W	0<W	0<W	0<W	0<W

Trace Metals (mg/l)

Iron	0.30	0.48	0.59	0.58	0.73	0.36	0.45	0.46	0.62	0.37	0.57	0.48
Manganese	0.015	0.100	0.110	0.082	0.072	0.042	0.069	0.063	0.059	0.040	0.048	0.049
Aluminum	0.13	0.43	0.45	0.42	0.41	0.21	0.30	0.29	0.39	0.17	0.24	0.23
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	0.014	0.032	0.034	0.034	0.017	0.033	0.029	0.026	0.015	0.02	0.02
Copper	0.002	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Mercury (ug/l)	<0.01	<0.01	<0.01	UCS!	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.002	<0.002	0.002	0.002	0.003	<0.002	<0.002	0.002	0.002	<0.002	<0.002	0.004
Lead	<0.003	<0.003	0.032	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.013	<0.003	<0.003
Strontium	0.029	0.036	0.034	0.033	0.031	0.032	0.030	0.029	0.030	0.028	0.028	0.028
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.002	0.014	0.014	0.011	0.010	0.007	0.012	0.010	0.010	0.060	0.038	0.025

Run	11											
Station	A	B	D	G	H	I	J	K	L	M	O	P
Date	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813
Time	04:00	04:15	04:34	04:55	05:02	05:08	04:00	04:13	04:28	04:35	04:50	15:05
Chlorinated Phenols (ng/l)												
246 Trichlorophenol	50<W	810	50<W	130<T								
245 Trichlorophenol	50<W	50<W	50<W	50<W								
234 Trichlorophenol	100<W	100<W	100<W	100<W								
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W								
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W								
Pentachlorophenol	50<W	50<W	50<W	50<W								
Phenoxy Acids (ng/l)												
Dicamba	100<W	ROI	ROI	ROI								
24D Propionic Acid	100<W	ROI	ROI	ROI								
24 Dichlorophenoxyacetic	100<W	ROI	ROI	ROI								
Silvex	50<W	ROI	ROI	ROI								
245 Trichlorophenoxyacetic	50<W	ROI	ROI	ROI								
24 Dichlorophenoxybutyrc	200<W	ROI	ROI	ROI								
Fatty Acids (ug/l)												
Capric	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Stearic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	10<W	15	10<W	LAI	13	10<W	10<W	10<W	10<W	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Aromatic Acids (ug/l)												
Benzoic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	11	13	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	10<W	13	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	25	25	12	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	18	10<W	10<W	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	250	123	30	10<W	LAI	10<W	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	80	44	24	16	LAI	14	11	10<W	10<W	10<W	10<W

Speciated Phenolics (ug/l)

Phenol	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI
Vanillin	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI
Homovanillic Acid	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI
Guaicol	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI
Syringaldehyde	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI
Acetovanillone	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI
Acetosyringone	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	LAI	SMI	SMI	SMI

Volatiles (ug/l)

11 Dichloroethylene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Dichloromethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
12 Dichloroethylene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
11 Dichloroethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Chloroform	0<W	195	179	133	120	78	106	80	70	57	67	55
111 Trichloroethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
12 Dichloroethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Carbontetrachloride	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Benzene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Trichloroethylene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Dichlorobromomethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Toluene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
112 Trichloroethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Chlorodibromomethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Tetrachloroethylene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Chlorobenzene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Trifluorochlorotoluene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Ethylbenzene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Ethylene Dibromide	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
M & P Xylenes	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
Bromoform	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
O-xylene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
1122 Tetrachloroethane	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
14 Dichlorobenzene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
13 Dichlorobenzene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W
12 Dichlorobenzene	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W	APSI	0<W	0<W	0<W	0<W

Trace Metals (mg/l)

Iron	0.30	BTI	0.54	BTI	BTI	BTI	BTI	BTI	BTI	0.38	BTI	BTI
Manganese	0.016	BTI	0.096	BTI	BTI	BTI	BTI	BTI	BTI	0.047	BTI	BTI
Aluminum	0.14	BTI	0.37	BTI	BTI	BTI	BTI	BTI	BTI	0.21	BTI	BTI
Beryllium	<0.001	BTI	<0.001	BTI	BTI	BTI	BTI	BTI	BTI	<0.001	BTI	BTI
Cadmium	<0.0003	BTI	<0.0003	BTI	BTI	BTI	BTI	BTI	BTI	<0.0003	BTI	BTI
Cobalt	<0.001	BTI	<0.001	BTI	BTI	BTI	BTI	BTI	BTI	<0.001	BTI	BTI
Chromium	<0.001	BTI	0.030	BTI	BTI	BTI	BTI	BTI	BTI	0.020	BTI	BTI
Copper	0.002	BTI	0.004	BTI	BTI	BTI	BTI	BTI	BTI	0.002	BTI	BTI
Mercury (ug/l)	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01
Nickel	<0.002	BTI	0.002	BTI	BTI	BTI	BTI	BTI	BTI	<0.002	BTI	BTI
Lead	<0.003	BTI	<0.003	BTI	BTI	BTI	BTI	BTI	BTI	<0.003	BTI	BTI
Strontium	0.027	BTI	0.033	BTI	BTI	BTI	BTI	BTI	BTI	0.028	BTI	BTI
Vanadium	<0.001	BTI	0.001	BTI	BTI	BTI	BTI	BTI	BTI	<0.001	BTI	BTI
Zinc	0.014	BTI	0.014	BTI	BTI	BTI	BTI	BTI	BTI	0.007	BTI	BTI

Run	13											
Station	A	B	D	G	H	I	J	K	L	M	O	P
Date	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813
Time	12:10	12:20	12:35	13:00	13:05	13:12	12:00	12:15	12:25	12:30	12:45	12:55
Chlorinated Phenols (ng/l)												
246 Trichlorophenol	50<W	1200	170<T	150<T								
245 Trichlorophenol	50<W	50<W	50<W	50<W								
234 Trichlorophenol	100<W	100<W	100<W	100<W								
2356 Tetrachlorophenol	50<W	70<T	50<W	50<W								
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W								
Pentachlorophenol	50<W	80<T	50<W	50<W								
Phenoxy Acids (ng/l)												
Dicamba	100<W	ROI	ROI	ROI								
240 Propionic Acid	100<W	ROI	ROI	ROI								
24 Dichlorophenoxyacetic	100<W	ROI	ROI	ROI								
Silvex	50<W	ROI	ROI	ROI								
245 Trichlorophenoxyacetic	50<W	ROI	ROI	ROI								
24 Dichlorophenoxybutyrc	200<W	ROI	ROI	ROI								
Fatty Acids (ug/l)												
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	11	10<W	13	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Stearic	18	10<W	21	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	16	10<W	10<W	10<W	10<W	10<W	10<W	10<W	17	17	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Aromatic Acids (ug/l)												
Benzoic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)												
Pimaric	10<W	14	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	17	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	40	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	173	10<W	10<W	10<W	10<W	10<W	10<W	10<W	21	12	12
Dehydroabietic	10<W	76	10<W	10<W	10<W	10<W	19	10<W	10<W			
Speciated Phenolics (ug/l)												
Phenol	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Vanillin	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Homovanillic Acid	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Guaicol	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Syringaldehyde	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Acetovanillone	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Acetosyringone	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Volatiles (ug/l)												
11 Dichloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Dichloromethane	0<W	CSI	CSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
12 Dichloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
11 Dichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Chloroform	0<W	98	153	109	122	0<W	131	102	85	48	70	48
111 Trichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
12 Dichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Carbontetrachloride	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Benzene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Trichloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Dichlorobromomethane	0<W	SPSI	1	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Toluene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
112 Trichloroethane	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Chlorodibromomethane	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Tetrachloroethylene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Chlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Trifluorochlorotoluene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Ethylbenzene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Ethylene Dibromide	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
M & P Xylenes	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
Bromoform	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
O-xylene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
1122 Tetrachloroethane	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
14 Dichlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI	0<W	0<W	0<W
13 Dichlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI	SPSI			
12 Dichlorobenzene	0<W	SPSI	SPSI	SPSI	SPSI							

Trace Metals (mg/l)

Iron	0.32	0.53	0.46	0.50	0.48	0.72	0.46	0.45	0.46	0.36	0.41	0.57
Manganese	0.017	0.100	0.089	0.079	0.084	0.053	0.075	0.073	0.069	0.043	0.056	0.051
Aluminum	0.01	0.46	0.38	0.36	0.36	0.46	0.34	0.32	0.33	0.20	0.24	0.18
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	0.008	0.025	0.027	0.028	0.017	0.026	0.025	0.023	0.017	0.022	0.017
Copper	0.001	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.001	0.002	0.001
Mercury (ug/l)	<0.01	0.02	LAI	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Strontium	0.024	0.032	0.028	0.030	0.030	0.025	0.029	0.033	0.029	0.029	0.024	0.028
Vanadium	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001
Zinc	0.003	0.017	0.015	0.005	0.002	0.001	0.001	0.002	0.001	<0.001	0.001	0.001

Run	15											
Station	A	B	D	G	H	I	J	K	L	M	O	P
Date	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813	860813
Time	20:05	20:25	20:40	21:00	21:05	21:15	20:00	20:10	20:20	20:25	20:35	20:45
Chlorinated Phenols (ng/l)												
246 Trichlorophenol	50<W	510	120<T	250<T								
245 Trichlorophenol	50<W	50<W	50<W	50<W								
234 Trichlorophenol	100<W	100<W	100<W	100<W								
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W								
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W								
Pentachlorophenol	50<W	50<W	50<W	50<W								
Phenoxy Acids (ng/l)												
Dicamba	100<W	ROI	ROI	ROI								
24D Propionic Acid	100<W	ROI	ROI	ROI								
24 Dichlorophenoxyacetic	100<W	ROI	ROI	ROI								
Silvex	50<W	ROI	ROI	ROI								
245 Trichlorophenoxyacetic	50<W	ROI	ROI	ROI								
24 Dichlorophenoxybutyric	200<W	ROI	ROI	ROI								
Fatty Acids (ug/l)												
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Stearic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Aromatic Acids (ug/l)												
Benzoic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	8	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	19	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	28	10<W	10<W	16	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	52	21	21	15	14	17	17	11	10<W	10<W	10<W

Speciated Phenolics (ug/l)

Phenol	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W
Vanillin	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W
Homovanillic Acid	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W
Guaicol	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W
Syringaldehyde	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W
Acetovanillone	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W
Acetosyringone	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	LAI	1<W

Volatiles (ug/l)

11 Dichloroethylene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Dichloromethane	0<W	APLI	SPSI	0<W	SPSI	CSI	CSI	CSI	0<W	0<W	0<W	0<W
12 Dichloroethylene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
11 Dichloroethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Chloroform	0<W	75	100	108	137	92	136	127	95	50	86	54
111 Trichloroethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
12 Dichloroethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Carbontetrachloride	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Benzene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Trichloroethylene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Dichlorobromomethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Toluene	0<W	SPSI	1	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
112 Trichloroethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Chlorodibromomethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Tetrachloroethylene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Chlorobenzene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Trifluorochlorotoluene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Ethylbenzene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Ethylene Dibromide	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
M & P Xylenes	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
Bromoform	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
O-xylene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
1122 Tetrachloroethane	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
14 Dichlorobenzene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
13 Dichlorobenzene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W
12 Dichlorobenzene	0<W	SPSI	SPSI	0<W	SPSI	0<W	SPSI	SPSI	0<W	0<W	0<W	0<W

Trace Metals (mg/l)

Iron	0.27	0.40	0.51	0.54	0.55	0.55	0.50	0.50	0.52	0.39	0.47	0.47
Manganese	0.014	0.093	0.088	0.096	0.099	0.076	0.092	0.088	0.061	0.052	0.069	0.060
Aluminum	0.11	0.44	0.39	0.37	0.36	0.34	0.37	0.34	0.23	0.20	0.26	0.21
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0003	<0.0003	0.0009	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	<0.001	0.006	0.028	0.029	0.032	0.024	0.030	0.029	0.018	0.019	0.022	0.020
Copper	0.002	0.003	0.003	0.004	0.004	0.004	0.004	0.003	0.002	0.002	0.003	0.003
Mercury (ug/l)	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002
Lead	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Strontium	0.024	0.037	0.030	0.038	0.037	0.033	0.035	0.035	0.034	0.029	0.032	0.031
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001
Zinc	<0.001	0.006	0.005	0.011	0.009	0.009	0.010	0.010	0.005	0.004	0.006	0.005

Run	17											
Station	A	B	D	G	H	I	J	K	L	M	O	P
Date	860814	860814	860814	860814	860814	860814	860814	860814	860814	860814	860814	860814
Time	04:00	04:12	04:27	04:46	04:53	05:03	03:54	04:05	04:13	04:23	04:35	04:46
Chlorinated Phenols (ng/l)												
246 Trichlorophenol	50<W	110<T	430<T	80<T								
245 Trichlorophenol	50<W	70<T	50<W	50<W								
234 Trichlorophenol	100<W	100<W	100<W	100<W								
2356 Tetrachlorophenol	50<W	50<W	50<W	50<W								
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W								
Pentachlorophenol	50<W	50<W	70<T	50<W								
Phenoxy Acids (ng/l)												
Dicamba	100<W	ROI	ROI	ROI								
24D Propionic Acid	100<W	ROI	320<T	ROI								
24 Dichlorophenoxyacetic	100<W	ROI	ROI	ROI								
Silvex	50<W	ROI	ROI	ROI								
245 Trichlorophenoxyacetic	50<W	ROI	ROI	ROI								
24 Dichlorophenoxybutyric	200<W	ROI	ROI	ROI								
Fatty Acids (ug/l)												
Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Stearic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	11	11	10<W	10<W	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Aromatic Acids (ug/l)												
Benzoic	10<W	97	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	11	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	13	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Isopimaric	10<W	10<W	19	11	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	32	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	198	180	88	48	47	10<W	10<W	10<W	11	10<W	10<W
Dehydroabietic	10<W	80	36	27	16	19	10<W	10<W	10<W	12	10<W	10<W

Speciated Phenolics (ug/l)

Phenol	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Vanillin	1<W	1<W	1<T	1<W	1<W	1<W	1<T	1<W	1<W	1<W	1<W	1<W
Homovanillic Acid	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Guaicol	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Syringaldehyde	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Acetovanillone	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Acetosyringone	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W	1<W

Volatiles (ug/l)

11 Dichloroethylene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Dichloromethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
12 Dichloroethylene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
11 Dichloroethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Chloroform	0<W	108	37	75	95	78	99	96	108	68	88	77
111 Trichloroethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
12 Dichloroethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Carbontetrachloride	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Benzene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Trichloroethylene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Dichlorobromomethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Toluene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
112 Trichloroethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Chlorodibromomethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Tetrachloroethylene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Chlorobenzene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Trifluorochlorotoluene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Ethylbenzene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Ethylene Dibromide	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
M & P Xylenes	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
Bromoform	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
O-xylene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
1122 Tetrachloroethane	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
14 Dichlorobenzene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
13 Dichlorobenzene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI
12 Dichlorobenzene	0<W	0<W	0<W	SPSI	SPSI	SPSI	SPSI	SPSI	SPSI	0<W	SPSI	SPSI

Trace Metals (mg/l)

Iron	0.28	0.45	0.54	0.51	0.85	0.48	0.48	0.46	0.47	0.44	0.48	0.50
Manganese	0.015	0.098	0.100	0.088	0.079	0.087	0.089	0.078	0.079	0.066	0.074	0.071
Aluminum	0.11	0.35	0.36	0.34	0.59	0.31	0.33	0.29	0.27	0.25	0.25	0.24
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0003	<0.0003	0.0004	0.0005	<0.0003	<0.0003	0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	0.001	0.007	0.028	0.028	0.023	0.026	0.028	0.023	0.023	0.020	0.022	0.020
Copper	0.002	0.004	0.004	0.004	0.004	0.003	0.004	0.003	0.003	0.003	0.003	0.003
Mercury (ug/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.024	<0.003	<0.003	<0.003	<0.003	<0.003
Strontium	0.031	0.040	0.040	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Vanadium	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.001	0.012	0.011	0.010	0.009	0.008	0.009	0.007	0.008	0.006	0.007	0.006

Run	18											
Station	A	B	D	G	H	I	J	K	L	M	O	P
Date	860814	860814	860814	860814	860814	860814	860814	860814	860814	860814	860814	860814
Time	08:00	08:05	08:20	08:33	08:38	08:43	07:55	08:05	08:12	08:20	08:32	08:45
Organochlorine (ng/l)												
PCB	20<W	20<W	20<W	ROI	ROI	20<W	20<W	20<W	20<W	20<W	20<W	20<W
Hexachlorobenzene	1<W	1<W	1<W	ROI	ROI	2<T	1<W	1<W	1<W	1<W	1<W	1<W
Heptachlor	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Aldrin	2<T	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
pp-DDE	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Mirex	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
a-BHC	1<T	1<W	1<W	ROI	ROI	3<T	1<W	2<T	3<T	2<T	3<T	4<T
b-BHC	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
g-BHC	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
a-chlordane	2<W	10<T	5<T	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W
g-chlordane	2<W	5<T	2<W	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Oxychlordane	2<W	2<W	2<W	ROI	ROI	7<T	2<W	2<W	2<W	2<W	2<W	2<W
op-DDT	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDD	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
pp-DDT	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
DMDT Methoxychlor	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
Heptachlorepoxide	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Endosulfan I	2<W	3<T	2<W	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endosulfan II	4<W	4<W	4<W	ROI	ROI	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Dieldrin	2<W	2<W	2<W	ROI	ROI	2<W	2<W	2<W	2<W	2<W	2<W	2<W
Endrin	4<W	4<W	4<W	ROI	ROI	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Endosulfan Sulphate	4<W	4<W	4<W	ROI	ROI	4<W	4<W	4<W	4<W	4<W	4<W	4<W
Octachlorostyrene	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Chlorobenzene (ng/l)												
Hexachloroethane	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
135 Trichlorobenzene	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
124 Trichlorobenzene	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
Hexachlorobutadiene	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
123 Trichlorobenzene	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
245 Trichlorotoluene	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
236 Trichlorotoluene	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
1235 Tetrachlorobenzene	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
1245 Tetrachlorobenzene	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
26a Trichlorotoluene	5<W	5<W	5<W	ROI	ROI	5<W	5<W	5<W	5<W	5<W	5<W	5<W
1234 Tetrachlorobenzene	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W
Pentachlorobenzene	1<W	1<W	1<W	ROI	ROI	1<W	1<W	1<W	1<W	1<W	1<W	1<W

Chlorinated Phenols (ng/l)

246 Trichlorophenol	50<W	300<T	770	370<T
245 Trichlorophenol	50<W	50<W	50<W	50<W
234 Trichlorophenol	100<W	100<W	100<W	100<W
2356 Tetrachlorophenol	50<W	60<T	60<T	50<W
2345 Tetrachlorophenol	50<W	50<W	50<W	50<W
Pentachlorophenol	50<W	CSI	90<T	CSI

Phenoxy Acids (ng/l)

Dicamba	100<W	ROI	ROI	ROI
24D Propionic Acid	100<W	ROI	ROI	ROI
24 Dichlorophenoxyacetic	100<W	ROI	ROI	ROI
Silvex	50<W	ROI	ROI	ROI
245 Trichlorophenoxyacetic	50<W	ROI	ROI	ROI
24 Dichlorophenoxybutyrc	200<W	ROI	ROI	ROI

Fatty Acids (ug/l)

Capric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Lauric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Myristic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palmitic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Stearic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Oleic/Linoleic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Arachidic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Aromatic Acids (ug/l)

Benzoic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Salicylic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Phthalic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W

Resin Acids (ug/l)

Pimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Sandaracopimaric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Palustric	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Levopimaric/Isopimaric	10<W	18	25	12	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Neoabietic	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W	10<W
Abietic	10<W	176	69	13	16	10	10<W	10<W	10<W	10<W	10<W	10<W
Dehydroabietic	10<W	45	75	27	22	14	10<W	14	10<W	11	11	10<W

Speciated Phenolics (ug/l)

Phenol	1<W	1<W	1<W	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W
Vanillin	1<W	1<W	1<T	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W
Homovanillic Acid	1<W	1<W	1<W	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W
Guaicol	1<W	1<W	1<W	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W
Syringaldehyde	1<W	1<W	1<W	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W
Acetovanillone	1<W	1<W	1<W	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W
Acetosyringone	1<W	1<W	1<W	1<W	1<W	1<W	LA!	1<W	1<W	LA!	1<W	1<W

Volatiles (ug/l)

11 Dichloroethylene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Dichloromethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	CS!	SPS!	SPS!	0<W	SPS!	SPS!
12 Dichloroethylene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
11 Dichloroethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Chloroform	0<W	90	86	90	98	80	87	87	82	74	85	78
111 Trichloroethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
12 Dichloroethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Carbontetrachloride	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Benzene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Trichloroethylene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Dichlorobromomethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Toluene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
112 Trichloroethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Chlorodibromomethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Tetrachloroethylene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Chlorobenzene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Trifluorochlorotoluene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Ethylbenzene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Ethylene Dibromide	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
M & P Xylenes	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
Bromoform	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
O-xylene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
1122 Tetrachloroethane	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
14 Dichlorobenzene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
13 Dichlorobenzene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!
12 Dichlorobenzene	0<W	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	SPS!	0<W	SPS!	SPS!

Trace Metals (mg/l)

Iron	0.27	0.46	0.60	0.51	0.49	0.54	0.53	0.59	0.47	0.42	0.47	0.52
Manganese	0.015	0.095	0.100	0.090	0.088	0.074	0.085	0.080	0.070	0.067	0.075	0.070
Aluminum	0.10	0.35	0.36	0.32	0.33	0.31	0.34	0.35	0.25	0.21	0.23	0.23
Beryllium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0003	<0.0003	<0.0003	0.0006	0.0004	<0.0003	0.0004	0.0004	0.001	<0.0003	<0.0003	<0.0003
Cobalt	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	0.001	0.007	0.023	0.03	0.028	0.021	0.028	0.024	0.024	0.02	0.022	0.019
Copper	0.002	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Mercury (ug/l)	<0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead	<0.003	0.004	0.008	0.005	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Strontium	0.029	0.040	0.040	0.034	0.035	0.034	0.034	0.034	0.033	0.034	0.033	0.033
Vanadium	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc	0.001	0.010	0.015	0.010	0.010	0.009	0.008	0.007	0.011	0.009	0.012	0.006